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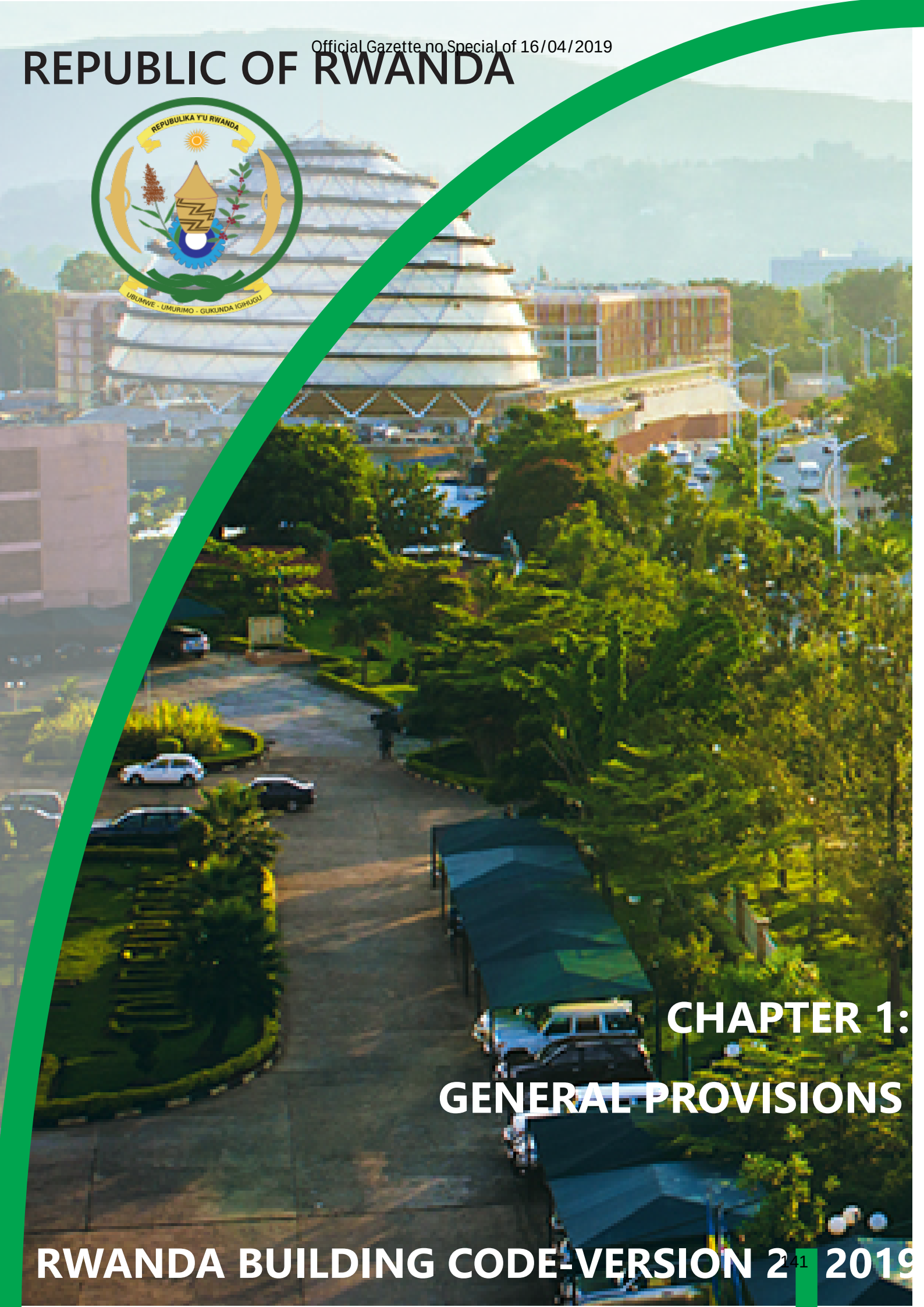
REPUBLIC OF RWANDA

RWANDA BUILDING CODE-VERSION 2 2019

REPUBLIC OF RWANDA



CHAPTER 1: GENERAL PROVISIONS

RWANDA BUILDING CODE

Chapter One:
GENERAL PROVISIONS

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RWANDA BUILDING CODE

Chapter One:
GENERAL PROVISIONS

PART 1:

APPLICATIONS OF PROVISIONS OF THE CODE

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PART 1: APPLICATIONS OF THE PROVISIONS OF THE CODE

SECTION 1: TITLE & PURPOSE

1.1.1.1. These regulations are hereby introduced to as Rwanda Building Code and shall be cited as such and are to be referred to as "the Code" and abbreviated as "RBC."

1.1.1.1. The purpose of this Code is to establish the minimum requirements to safeguard the public health, safety and general welfare. This is done through regulating, controlling, and monitoring the design, construction, quality of materials, use and occupancy, location, maintenance, sanitation, lighting and ventilation, energy conservation, and safety including measures to protect life and property from fire and other hazards attributed to the built environment, for all buildings and related non-building structures in Rwanda.

1.1.1.2. This Code is divided into six (6) chapters, fifteen parts (15) and one hundred and seven (107) sections; each chapter is comprised of at least one part and each part is comprised of multiple sections and each section is comprised of several regulations.

SECTION 2: SCOPE & APPLICATION

1.1.2.1. The provisions of this Code shall apply to site planning, building site operations, materials selection, construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, maintenance, removal and demolition of any building or structure or any appurtenances connected or attached to such buildings or structures in Rwanda.

1.1.2.2. Throughout the world, buildings and other construction works are designed to meet standard requirements, expressed and established in national and international standards or regulations particular to a jurisdiction. None of these requirements is replaced or changed by this Code.

1.1.2.3. The Rwanda Building Code has been prepared by referring to different laws governing the building construction industry and was given legal effect by the Ministerial Order determining Urban Planning and Building Regulations.

1.1.2.4. In the event that any part or provision of this Code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions of the Code.

1.1.2.5. The legal occupancy of any structure existing on the date of promulgation of this Code shall be permitted to continue without change, except as is specifically covered in this Code or as is deemed necessary by the Building Consent Authority to comply with the current master plan or/and ensure the general safety and welfare of the occupants and the public.

1.1.2.6. For purposes of public safety and accessibility for people with disability, permittees shall be obliged to comply with the provisions of this Code even if the building was in place before this Code came into existence.

SECTION 3: STRUCTURE & CHAPTER SYNOPSIS

1.1.3.1. The Rwanda Building Code performance-based; it is essentially formulated in a manner that defines objectives, functional and performance requirements for each element defined and outlined in it the code to ensure compliance with the regulations.

1.1.3.2. Wherever possible, in performance-based code approach, solutions that minimally meet the performance requirements are given, while allowing sufficient room for alternative acceptable solutions generated by or for the end users.

1.1.3.3. **Chapters Synopsis:** The Rwanda Building Code is structured in 6 chapters, 15 parts and 107 sections. It comprises regulations for design, construction and other guidelines for the defined components or requirements of buildings and structures making reference to indispensable national, regional or international standards and other codes of practice as deemed appropriate.

1.1.3.4. **CHAPTER 1- GENERAL PROVISIONS**

This chapter is divided into five (5) parts within which they contain a total of thirty-six (36) sections which establishes the limits of applicability of the Code and describes how it is to be applied and enforced.

The Code identifies which buildings and structures come under its scope and defines technical terms as used in this Code and gives reference to other Codes used while establishing this code. This chapter also details the duties of the competent authority in charge of enforcement of this Code. Procedures for obtaining development and building permits, and responsibility of all professionals involved in the planning, design and construction of the building are outlined.

The chapter further establishes the classification of building structures and sets guidelines about development control rules and general requirements for proper planning and design at the layout and building level to ensure public safety and desired quality of life including considerations for people with disabilities

1.1.3.5. CHAPTER 2- STRUCTURE & BUILDING MATERIALS

This chapter provides for structural adequacy of buildings for both internal and external environment. It prescribes minimum structural loading requirements for use in the design and construction of buildings and structural components. It includes minimum design loads, as well as permitted design methodologies. Standards are provided for minimum design loads (live, dead, wind, rain, floods and earthquakes as well as load combinations).

The chapter references rely on many internationally recognized design standards. In particular the chapter covers several components of the building including, but not limited to:

(i) **Soils, Excavations and Foundations**- It covers structural design (principles) of all building foundations, such as raft, pile and other foundation systems to ensure safety and serviceability without exceeding the permissible stresses of the materials of foundations and the bearing capacity of the supporting soil.

(ii) **Walling and Roofs**- It covers or formwork structural design aspects of unreinforced load bearing and non-load bearing walls, constructed using various bricks, stones and permitted blocks, covers provisions for design of reinforced brick and reinforced brick concrete floors, roofs assemblies, roof structures and re-roofing. It also covers guidelines regarding earthquake resistance of low strength masonry buildings.

(iii) **The masonry** provides comprehensive and practical requirements for masonry construction with required minimum accepted practices and the use of standards for the design and construction of masonry structures- It addresses: material specifications and test methods; types of wall construction; criteria for engineered and empirical designs; required details of construction including the execution works Masonry design methodologies include allow-able stress design, strength design and empirical design. Also addressed are masonry fire-places and chimneys, masonry heaters and glass unit masonry

(iv) **Concrete** - It provides minimum acceptable practices to the design and construction of buildings and structural components using concrete-both plain and reinforced, addressing concrete slabs, anchorage to concrete, and reinforced gypsum concrete and concrete-filled pipe columns.

(v) **Floors –** It provides minimum acceptable practices to the design and construction with various types of materials

(vi) **Systems Building and Mixed/Composite Construction**- It covers recommendations regarding modular planning, component sizes, joints, manufacture, storage, transport and erection of prefabricated elements for use in buildings and such related requirements for mixed/composite construction. It also covers recommendations regarding modular planning, component sizes, prefabrication systems, design considerations, joints and manufacture, storage, transport and erection of prefabricated concrete elements for use in buildings and such related requirements,

Part seven (7) of this chapter deals with materials and includes the requirements of other building materials and components, and criteria for evaluating and adopting or alternative building materials and components and provides guidance to structural engineers for varied usage of material/technology types for building design. This section integrates the local Rwandan building materials and the concepts of using local names.

1.1.3.6. CHAPTER 3- FIRE SAFETY

The provisions of this chapter present the fundamental concepts of fire performance that all buildings are expected to achieve in some form. This chapter identifies the acceptable materials, techniques and design methods for buildingability to limit the impact of fire. Types of separations addressed include fire walls, fire barriers, fire partitions, horizontal assemblies, smoke barriers and smoke partitions and interior finishes.

The requirements of these sections work in unison with height and area requirements in Chapter 1, and active fire detection and suppression systems and occupant egress requirements that prescribes the minimum requirements for

active systems of fire protection equipment to detect a fire; alert the occupants or fire department of a fire emergency; and control smoke and control or extinguish the fire. Generally, the requirements are based on the occupancy, the height and the area of the building, because these are the factors that most affect fire-fighting capabilities and the relative hazard of a specific building or portion thereof. The general requirements for accessibility and evacuation are set forth in this section regulating the design of the means of egress and establishing primary methods for protection of people in buildings by allowing their timely relocation or evacuation.

Both prescriptive and performance languages are utilized in this chapter to provide a basic approach in the determination of a safe exiting system for all occupancies. It addresses all portions of the egress system and includes design requirements as well as provisions regulating individual components.

The requirements detail the size, arrangement, number and protection of means of egress components. Functional and operational characteristics are also specified for the components that will permit their safe use without special knowledge or effort. This chapter also contains provisions that set forth requirements for accessibility of buildings and their associated sites and facilities for people with disabilities. The fundamental philosophy of the Code on the subject of accessibility is that every building and related facility is required to be accessible.

1.1.3.7. CHAPTER 4- BUILDING SERVICES

This chapter elaborates on utilities and provides detailed guidance to concerned professionals/utility engineers for meeting necessary functional requirements in buildings. Part eleven of this code contains thirteen sections and is discussed here under:

(i) **Energy Efficiency**- The purpose of this part is to provide minimum design requirements that will promote efficient utilization of energy in buildings. The requirements are directed towards the design of building envelopes with adequate thermal resistance and low air leakage, and towards the design and selection of mechanical, water heating, electrical and illumination systems that promote effective use of depletable energy resources.

(ii) **Lighting and Ventilation**- It covers requirements and methods for lighting and ventilation of buildings.

(iii) E**lectrical Installations**- It covers the essential requirements for electrical and related installations in buildings to ensure efficient use of electricity including safety from fire and shock. This section also includes general requirements relating to lightning protection of buildings.

(iv) **Air Conditioning, Heating and Mechanical Ventilation**- This Section covers the design, construction and installation of air conditioning and heating systems and equipment installed in buildings for the purpose of providing and maintaining conditions of air temperature, humidity, purity and distribution suitable for the use and occupancy of the space.

(v) **Acoustics, Sound Insulation and Noise Control**- It covers requirements and guidelines for noise control, acceptable noise levels and the requirements for sound insulation in buildings with different occupancies

(vi) **Stairways, Ramps and Guarding**- It covers elements of accessibility to all types of buildings for all its users including people with disability

(vii) **Lifts and Escalators**- It covers the essential requirements for the installation, operation, maintenance and also inspection of lifts (passenger

lifts, goods lifts, hospital lifts, and service lifts) and escalators so as to ensure safe and satisfactory performance.

(viii) **Security systems**- It covers all fittings and installations to monitor the movement of people entering and exiting the building to ensure security in the premises

(ix) **Telecommunication installations**- It covers all fittings and related accessories for broadband/internet in the building

(x) **Plumbing & Drainage**- **Plumbing** gives detailed guidance to concerned plumbing professional engineers with regard to all plumbing installations with related requirements in buildings like gas, rainwater and drainage. It covers the basic requirements of water supply for residential, business and other types of buildings, including traffic terminal stations. This Section also deals with general requirements of plumbing connected to public water supply and design of water supply and storage systems. **Drainage**- covers the design, layout, construction and maintenance of drains for foul water, surface water and sub-soil water and sewage; together with all ancillary works, such as connections, manholes and inspection chambers within and from the building and their connection to a public or private sewer, individual sewage-disposal system, cesspool, soak away or to other approved point of disposal/ treatment work. It also includes the provisions on solid waste management

(xi) It also covers the requirements regarding the safety of persons and property for all piping uses and for all types of gases used for fuel or lighting purposes in buildings

(xii) **Waterborne sanitation**- It covers liquid wastes in the building

(xiii) **Non**- Waterborne sanitation- It covers all types of pit latrines and their applications in building

(xiv) **Solid waste management**- It covers all types of solid wastes resulting from the use of buildings and appropriate methods of management

1.1.3.8. CHAPTER 5-CONSTRUCTION SAFETY, INSPECTION, MAINTENANCE & DISASTER RISK MANAGEMENT

This chapter covers the construction planning, management and practices in buildings; storage, stacking and handling of materials, safety of personnel during construction works and demolition of buildings. It also covers guidelines relating to maintenance management, repairs, retrofitting and strengthening of buildings. The objective can be best achieved through proper coordination and working by the project management and construction management teams. These provisions deal with alternative methods or reduced compliance requirements when dealing with existing building constraints. This section allows for a controlled departure from full compliance with the technical Codes, without compromising the minimum standards for fire prevention and life safety features of the rehabilitated building. Provisions are divided by addition, alterations, repairs, change of occupancy and moved structures. There are also specific allowances for replacement of existing stairways, replacement of glass and accessibility requirements. The fire escape requirements in this section are also included.

The chapter also provides regulations and considerations for maintenance of existing buildings and installations therein, to protect occupants of existing buildings and structures from health and safety hazards arising from the improper maintenance and use of those buildings and structures. It also provides guidelines to protect occupants of existing buildings and structures from health and safety hazards arising from the improper maintenance and use of those buildings and structures.

It also contains specific guidelines to the rehabilitation of existing buildings that may be used as an acceptable alternative to the purpose and context of Rwanda. The purpose of this section is to facilitate the rehabilitation of vacant, substandard or unsafe building and non-building structures. It also deals with requirements and guidelines for inspection of existing buildings, site for new constructions inspections, post disasters, inspections for refurbishment. It also provides general guidelines for inspection works during all stages of construction for quality

assurance as opposed to quality inspection. Guidelines for scientifically based reporting, measurement and professional assessment are provided as widely as possible to achieve performance-based Code adequacy. Required forms are provided in the general provisions with notices and forms. It finally deals with disaster management considerations for purposes of protecting lives and property; emphasis is placed on potential hazard assessment, post disaster recovery centers and mechanisms for alleviation in different classifications of buildings and the regions of the country. Components of risk mitigation are also included.

1.1.3.9. CHAPTER 6- SPECIAL PROVISIONS

This chapter deals with techniques and local unique construction methods and procedures to different areas of the country. It also provides requirements for sustainable design, construction and affordability as well as maintaining and promoting local approaches in solving engineering, architectural, environmental and related problems associated with buildings and non-building structures while ensuring an all-inclusive building Code.

This chapter promotes the use of indigenous knowledge and home-grown solutions as practically possible but not limited to the following in:

(i) Dealing with special construction exemptions for areas of steep slopes, problematic soils, disaster prone areas of the country, unplanned areas specific rural areas, and densely populated settlements, mobile homes, security facilities and buildings.

(ii) Dealing with green construction practices for buildings and other structures for resource efficiency, sustainability and affordability aspects including both optimal land use, waste management, erosion control in construction zones, sub-structure and super structure systems and multi-functional public spaces (such as may be used for both recreation biodiversity maintenance and simultaneous waste treatment and flooding controls/alleviations).

(iii) Dealing with possible and appropriate incentives to motivate and encourage investors to invest in green construction projects as they can be expensive in the short term but sustainable in the long term

(iv) Dealing with special local materials for walling, binding, roofing, flooring and interior finishing applications with a focus on local availability and innovation in addition to the special indigenous techniques and constructions as well as local materials considerations in the structure and materials chapter.

(v) Dealing with special communal settlements “Imidugudu” considerations particularly focusing on engineering, architectural and environmental aspects of innovating for cost reductions and sustainability as well as associated general guidelines.

(vi) Dealing with historic buildings, memorial and burial sites considerations (including mausoleums, museums, memorials and cemeteries, etc) with regards to location, construction and special maintenance requirements.

(vii) Dealing with incremental building conditions and guidelines geared towards facilitating partial construction and occupancy for different functions and uses of buildings.

RWANDA BUILDING CODE

Chapter One:
GENERAL PROVISIONS

PART 2:

INTERPRETATIONS

CONTENTS

PART 2 : INTERPRETATIONS

SECTION 1 : GENERAL PROVISIONS

1.2.1.1. **Interpretation of the Code:** The laws, regulations and instructions under reference in this Code shall be read together with the provisions of this Code. Where there is conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. The provisions of this Code shall not be deemed to nullify any provisions of other Rwanda laws.

1.2.1.2. **Review of the Code:** The Code shall be subject to review, changes and/or amendments at any time when it shall be deemed necessary in order to keep pace with changes in the building and construction industry as well as advancement in building construction science and technology.

1.2.1.3. **Reference Standards**: For all international referenced standards used in this Code, Rwanda Standards shall take precedence as and when they are developed, adopted and/or adapted. And the users of this Code shall ensure they apply appropriate parts of the latest versions of the standards in force.

SECTION 2: DEFINITIONS

1.2.2.1. For the purpose of this Code, the following terms shall be defined as follows:

Acceptable **Adequate** **Appropriate** **Satisfactory** **Suitable**	Means acceptable, adequate, appropriate, satisfactory or suitable: a. in the opinion of any local authority or b. in relation to any document issued by the c. Building Control Authority or Building Consent d. Authority, e. in the opinion of the Building Control f. Authority or Building Consent Authority
Escape Door	Means an entrance to an escape or emergency route.
Access Opening	Entrance leading to a building/structure.
Accessory	A device associated with current using equipment or with the wiring of an installation; for example, a switch, a plug, a socket outlet, a lamp holder, or a ceiling rose.
Accredit	Give authority or sanction to a public or private company, firm, association, organisation or individual when recognized standards have been met.
Accreditation	Is the process in which certification of competency, Authority, or credibility is presented.
Additive	Material added in small quantities to a liquid or granular material to produce some desired modification to its properties.
Adjoining property	Means land, including any street, highway, lane, footway, square, alley and right of way, situated in relation to the site on which building work is to occur as to be at risk of significant damage from the building work.
Admixtures	Additive substances added to concrete during mixing for special role.

Aggregate	Granular material, such as sand, gravel, crushed stone, and iron blast-furnace slag, used with a cementing medium to form a hydraulic cement concrete or mortar.
Air changes	The rate of air entering or leaving a space by natural or mechanical means in terms of the volume of the space.
Air Conditioning Control System	An automatic control system, designed to stop mechanically induced air movement within a designated fire compartment, actuated by smoke detectors and provided with a central, manually operated back up facility.
Air Conditioning System	A system of mechanical ventilation where air that has been cleansed is supplied to a building under conditions of controlled temperature, humidity, distribution and movement.
Air Conditioning	The process of treating air so as to control simultaneously its temperature, humidity, purity, distribution and movement to meet the requirements of the air conditioned space.
Air Duct	A pipe, tube, conduit or enclosed space used or to be used in any building for the transmission of air in an artificial ventilation system.
Air Exhausts	Air other than recycled air, removed from an enclosure and discharged to atmosphere.
Air Gap	Means the unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to tank, plumbing fixture or other device and the flood level rim of the receptacle.

Air-Supported Structure	Structure formed by a thin flexible membrane that is supported by air pressure.
Air-Inflated Structure	A structure that uses air-pressurized membrane beams, arches or other elements to enclose space. Occupants of such a structure do not occupy the pressurized area used to support the structure.
Airport	Whole of the land and installations necessary for air traffic serving a town or a region
Annunciator	A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.
Apartment	A living place made up of several adjoining rooms, situated in a building which has several rooms.
Apparatus	Electrical apparatus including all machines, appliances and fittings in which conductors are used or of which they form ~~a~~ part.
Appliance	Any device which uses electricity excluding a light fitting or independent motor.
Applicant	Any person who makes an application under these building regulations.
Application	A request made under these building regulations.
Approved Plan	Refers to the drawing plan retained by the building consent authority being a true copy of the plan or plans approved.
Approved	Accepted by the Building Control Authority and/or Building Consent Authority as appropriate.

Architect	A person who is registered in accordance with the law governing architects and engineers.
Artificial Ventilation System	A system in which air is caused to circulate through a room by means of a mechanical apparatus which forces air into or extracts air from such room.
Audible Alarm Notification	Notification appliance that alerts by the sense of hearing.
Automatic Gate	A gate that is intended for use at a vehicular entrance or exit to a facility, building or portion thereof, and that is not intended for use by pedestrian traffic.
Automatic Smoke Detection System	A fire alarm system that has initiation devices that utilizes smoke detectors for protection of an area such as a room or space with detectors to provide early warning of fire.
Backfill	Materials used or re-used to fill an excavation.
Backflow	The flow of water or other liquids, mixtures or substances into the distribution pipes of a potable water supply from any source other than its intended source.
Backup Battery	This is a rechargeable battery that provides power to the building security system in the event that the AC power is no longer functioning.
Balcony	Any stage, platform, oriel window or other similar structure projecting outwards from or recessed into the wall of a building and supported by brackets or cantilevered.
Balustrade	Is a row of balusters meant for supporting moving handrails.

Bamboo	Tall perennial grasses found in tropical and sub-tropical regions, they belong to the family Phocaea and sub-family Bambusoidae.
Bar	Rigid solid section of any cross-sectional area small in relation to its length.
Barricade	Any object or structure that creates a barrier or obstacle to control, block passage or force the flow of traffic in the desired direction.
Barrier	Something (such as a fence or natural obstacle) that prevents or blocks movement from one place to another
Base	Element that supports the flooring.
Basement Storey	Means a storey the floor of which is situated at such a level that more than half the height of the storey is below the level of the ground adjoining its perimeter walls for more than half the length of the perimeter walls.
Basement	Shall mean that portion of a building, which is partly or completely below ground level.
Bath	Long open vessel for washing oneself in.
Beam	Structural member designed to carry loads between or beyond points of support, usually narrow in relation to its length and horizontal or nearly so.
Bidet	Low basin for sitting astride on to wash genitals.
Block	Any masonry unit which has a length of more than 300mm or a width of more than 130mm.

Borehole	A sinking made in the ground by the process of boring so as to obtain water.
Boundary	In relation to a building or compartment means the boundary of the plot or lot belonging to the building.
Boundary Wall	Any wall, fence, enclosure or screen built on or along the boundary line of a parcel of land for the purpose of separating the land from another adjoining parcel of land.
Bracket	Support projecting horizontally from a vertical surface.
Branch Circuit, General Purpose	A branch circuit that supplies a number of outlets for lighting and appliance.
Branch Circuit, Appliance	A branch circuit supplying energy to one or more outlets to which appliances are to be connected; such branch circuits do not have any permanently connected lighting fixtures except those that are integral parts of the appliances themselves.
Branch Circuit, Individual	A branch circuits that supplies only one utilization equipment.
Branch- Distribution Board	Located in the same floor of a building and connected to one of the Sub Distribution Boards in the same floor.
Brick	Any masonry unit that is not a block.
Builder	Any person who is or will be responsible for the works on site.

Building Consent Authority	Refers to the City of Kigali or District One Stop Centre for building construction or any other body permitted by the Building Control Authority to undertake planning and building control including granting building permits and inspect building construction works.
Building Control Authority	Refers to the authority in charge of human settlement meant to efficiently organize and manage the building construction industry.
Building Coverage	Means the percentage of the plot area occupied by the ground area of the primary and all ancillary buildings on such plot, inclusive of the shadow area created by cantilevered building projections.
Building Element	Major functional part of a building, for example: foundation, floor, roof, wall, services.
Building Envelope	The elements of a building which enclose air conditioned spaces through which thermal energy may be transferred from the exterior.
Building Fabric	Elements and components of a building other than furniture and services.
Building Height	The dimensional height in metres measured from the lowest ground level abutting any part of the building to the level.
Building Line	In relation to a site, means a line prescribed in any town planning scheme or any other law designating the boundaries of the area of the site outside of which the erection above ground of any building is prohibited.

Building Maintenance	Work undertaken to maintain or restore the performance of the building fabric and its services to provide an efficient and acceptable operating environment to its users.
Building Official	An officer of the Building Control Authority or Building Consent Authority who is responsible for carrying out the provisions of this Code as well as the enforcement of the provisions of this Code.
Building Plan/Layout Drawing	Is an orthographic drawing of a building on a horizontal plane and a horizontal section.
Building Professional	A person engaged or qualified in a building profession.
Building Refurbishment	The action of renovating a building including structural or aesthetic work, modernizing or restoring to a previous condition.
Building	Any structure constructed to meet the requirements of sheltering its contents or users which is designed to attain safety standards as required by the requirements of this Code.
Bypass	This term is in reference to the ability to deactivate specific zones of the building or home before arming the system. Bypassing allows for certain areas of the home to be unmonitored while the rest of the home is monitored.
Cable	A length of single insulated conductor (solid or stranded), two or more conductors, each provided with its own insulation.

Canopy	A roof like ornamental projection, over a niche, door, window, etc, a covering, an overhanging shade or shelter used especially of the firmament.
Capacity	of any storage tank means the volume of such tank between the operating level of the water contained in such tank and the invert level of the outlet from the tank.
Car Parking	A space or building intended to provide for storage of a motor vehicle, caravan or boat.
Cast Iron	Hard alloy of iron, carbon, and silicon cast in mould.
Cast-in-Situ	Cast in place; cast liquid in its permanent location, where it hardens as part of the building, as opposed to pre-cast.
Cavity Wall	A wall constructed in two separate thicknesses with an air space in between; also known as a hollow wall.
Ceiling Rose	A ceiling rose is used for terminating the point wiring for a Light or a Fan in the ceiling.
Ceiling	Construction made of plaster, boards, or other material covering the underside of a floor or roof to provide the overhead surface of an enclosed space.
Central Station	The term “central station” is used interchangeably with the term “monitoring center.” This refers to the location that alarm monitoring companies use to monitor alarm systems.
Certified Valuer	A competent person authorized, under this Law, to conduct real property valuation as a profession in

	compliance with standards and regulations applicable in Rwanda.
Characteristic Strength	Strength of material below which not more than 5 percent of the test results are expected to fall.
Chemical Closet	Closet with a fixed pan, the excreta from which passes into a tank where it is acted upon by chemicals which sterilize and break it down.
Chimney	A vertical, hollow structure of masonry, steel, or concrete, built to convey gaseous products of combustion from a building.
Circuit Breaker	A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined over current, without injury to itself when properly applied within its rating.
Circuit	An assembly of electrical equipment supplied from the same origin and protected against over current by the same protective device.
Cladding	To furnish, surround, adorn, to cover, conceal exterior of a building. A material used for covering a structural element.
Clearance Between Rows of Seats	Means the distance as measured between plumb lines from the rearmost part of any seat to the nearest part, including armrests if any, of the seat behind it: Provided that in the case of gravity-operated automatic tip-up seats such distance may be measured with the seats in the tipped-up position.

Client	Person who in the course or furtherance of a business, seeks or accepts the services of another which may be used in the carrying out of a project for him ; or carries out a project himself.
Column	An isolated vertical load bearing member, width of which does not exceed four times the thickness.
Comfort, Thermal	Condition of mind derived from satisfaction with the thermal environment. Thermal comfort is the combined thermal effect of environmental parameters including air temperature, relative humidity, air movement, mean radiant temperature (fixed factors) and clothing and activity level of occupants.
Commercial Building	A building, or that part of the building, constructed or intended to be used for business, trade or entertainment.
Communicator	This is a module within the building security system that digitally dials in to the central station. The communicator is responsible for relaying information about the home that is ascertained by the home security system.
Competent Authority	The competent authority appointed or approved under these regulations**.**
Competent Person	Means a person possessing adequate qualifications such as suitable training and sufficient knowledge, experience and skills for the safe performance of specific work in accordance with this Code.
Component	Product manufactured as a distinct unit to serve a specific function or functions.

Composite Construction	A generic term to describe any building construction involving multiple dissimilar materials and exists when two different materials are bound together so strongly that they act together as single unit from a structural point of view.
Composite Members	Structural members comprising prefabricated structural units of steel, pre-stressed concrete or reinforced concrete and cast in-situ concrete connected together in such a manner that they act monolithically.
Compost Toilet	Composting toilet is a dry toilet that uses a predominantly aerobic processing system to treat human excreta, typically with non-water or very small volumes of flush water, by composting or managed aerobic decomposition
Concrete Slab	Rigid horizontal or nearly horizontal concrete construction of a large area relative to its thickness.
Concrete	A mixture of cement, sand, and gravel, with water in varying proportions, according to the use which is to be made of it, in compliance with the specifications for concrete in these regulations.
Condensate	The liquid formed by the condensation of a vapor, such as water which is extracted from moist air as it flows across the cooling coil of an air-conditioner.
Condenser	A vessel or arrangement of pipes or tubing's in which vapour is liquefied by removal of heat.
Confined Space	Space which may be inadequately ventilated for any reason and may result in a deficiency of oxygen, or a build-up of toxic gases.

Contacts	These are the small sensors that are placed on doors and windows of the home so that the home security system can monitor whether a door or window is open or closed.
Contaminant, Airborne	An unwanted airborne constituent that may reduce acceptability of the indoor air quality
Contractor	Any person (including a client, principal contactor or other person referred to in these regulations) who in furtherance of business, carries out or manages construction work
Control Panel	This refers to the main components of the alarm system which contain the backup battery and the main circuit board of the system.
Cooling Tower, Water	An enclosed device for the evaporative cooling of water by contact with air
Coping	Unit or assemblage placed at the head of a wall and designed to shed rainwater from the top of the wall clear of all exposed surfaces of the walling beneath.
Cord, Flexible Cables	A flexible cable having large number of strands of conductors of small cross-sectional area with a soft PVC insulation.
Corridor	Means a covered passageway, which limits means of egress to a single path of travel.
Crane	Is a type of machine or is a mechanical system designed to lift and lower heavy materials and transporting them to the other places.
Critical Radiant Flux	The minimum radiant energy a fire needs to sustain flame propagation on the material. The lower the critical radiant

	flux result numbers, the greater the tendency of the material to spread flame.
Critical Section	It is the net section obtained by deducting the projected area of bolt-holes from the cross-sectional area of member.
Cross Connection	Any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other, either water of unknown or questionable safety or steam, gas, or chemical whereby there may be a flow from one system to the other, the direction of flow depending on the pressure differential between the two systems.
Curing	Is the process of preventing the loss of moisture from the concrete whilst maintaining a satisfactory temperature regime.
Curtain Wall	A thin wall of glass, plain or other, to cover the exterior surface of the building, supported by the structural frame of the building.
Cut Out	Any appliance for automatically interrupting the transmission of energy through a conductor when the current rises above some predetermined value.
Cutting	An open excavation through a hill, for carrying a highway or rail-road at a lower level than the surrounding ground.
Damper	A device used to vary the volume of air passing through an air out inlet or duct.
Damp Proof Course	Layer or sheet of impervious material within a floor or a similar construction or membrane vertically within a wall

	or chimney to prevent passage of moisture, also Known as damp proofing.
Dead Loads	The weight of materials of construction incorporated into the building.
Debris Actions	Impact actions caused by objects transported by flood waters striking against buildings and structures must be determined using engineering principles as concentrated loads acting horizontally at the most critical location at or below the design flood level.
Deck	An outdoor attached to a building made of only wood or wood like.
Demolition Permit	The document issued by the Building Consent Authority authorizing demolition of all or part of a building.
Demolition Works	The works carried out in the process of pulling down of the super-structure of a building and/or the removal of, or material alteration to the sub-structure, as may be required.
Demolition	Destroy by disintegration of the fabric. To pull or throw down, reduce to ruin.
Design Strength	The product of the nominal strength and a resistance factor.
Designer	Any person (including a client, Contractor or other person referred to in these regulations) who executes designs as for works of art.
Developer	Any person who has obtained the approval of the building consent authority to develop any land pursuant to these

	regulations and includes his/her executors, administrators and successors in title or assigns.
Development	Any material change on land.
Diaphragm, Structural	A large structural element placed in a building as a wall, or roof, used to resist horizontal forces such as wind or earthquakes-acting parallel to its own plane.
Direct Digital Control	The use of microcomputer to directly perform the control logic for control loops.
Discharge Pipe	A pipe which conveys the discharge from a sanitary fixture to a drain, and includes a soil pipe, a waste pipe, a discharge stack, a branch discharge pipe or a fixture discharge pipe.
Distribution Board	It is a box where the main incoming cable enters and terminates from the main service feed connection.
Domestic Buildings	Buildings used for dwelling purposes including dwelling houses, flats, student accommodation and residential homes.
Domestic Effluent	Sewage consisting of soil water or waste water or a combination of both.
Door	Includes any shutter, cover or other form of protection to an opening in a wall or floor of a building or in the structure surrounding a protected shaft whether the door is constructed of one or more leaves.
Door and Window Sensor	These sensors are usually two parts. One sticks to the door or window, while the other sticks to the stationary part of the home.

Door Frame	A solid frame in which a door is hung.
Double Skin	Similar to a single skin, but with an attached liner that is separated from the outer skin and provides an airspace which serves for insulation, acoustic, aesthetic or similar purposes.
Down Pipe	A pipe (usually vertical) for conveying rainwater from the gutter to the drain or to an intermediate gully.
Drain	Means a conduit or channel used for the drainage of a building or premises within the same cartilage.
Drainage Installation	Any installation vested in the owner of the site and which is situated on such site and is intended for the reception, conveyance, storage or treatment of sewage, and may include sanitary fixtures, traps, discharge pipes, drains, ventilating pipes, septic tanks, conservancy tanks, sewage treatment works, or mechanical appliances associated therewith.
Drainage System	In relation to a building means a system of pipes and sewers used for the sewerage of a building, including any fitting, appliance or equipment connected therewith.
Drawings	Documents in a graphical form, sketches, drafts, and measured, showing the designer's general intentions.
Dropped Curb	It is the dip in the path and curb that lets you drive up to your house or facility.
Duct Covering	Duct covering includes materials such as adhesives, insulation banding, coating(s), film and jacket used to cover the outside of duct, fan casing or duct plenum.

Duct or Trunking	An enclosed space which is used to house and conceal cables and includes spaces provided in a wall and in the skirting of walls and partitions.
Duct	Enclosing construction formed for the passage of air, gases, cables, pipes, etc.
Durability of Concrete	A durable concrete is a concrete which performs satisfactorily in the working environment during its anticipated exposure conditions during service.
Dwelling Unit	Means a unit containing one or more habitable rooms and provided with adequate and safe sanitary and cooking facilities and is lawfully, used or constructed, adapted or designed to be used as a residence for one family.
Dwelling	A building or structure used regularly or intermittently for human habitation.
Dynamic Load	A load which is not static for example loads due to moving machinery or earthquake.
Earth Continuity Conductor	The conductor, including any clamp, connecting to the earthling lead or to each other, those parts of an installation which are required to be earthed.
Earth Electrode	A metal plate, pipe or other conductor electrically connected to the general mass of the earth.
Earth Lead Wire	The final conductor by which the connection to the earth electrode is made.
Earthed	In relation to a connection, means effectively connected to the general mass of the earth.

Earthworks	Engineering works created through the moving or processing of quantities of soil or unformed rock.
Eaves	Lower edges of a pitched roof or the edge of a flat roof overhanging a wall.
Egress	A means of going out or exit.
Elevation	A vertical view of a building, element or of a building component.
Emergency Lifts	Is a lift designed principally for a serious situation or occurrence that happens unexpectedly and demands immediate action.
Emergency Lighting	Lighting provided for use when the supply to the normal lighting fails.
Emergency Route	That part of an escape route which provides fire protection to the occupants of any building and which leads to an escape door**.**
Emergency Stop Push or Switch	Is push button or switch provided inside the lift car designed to open the control circuit to cause the lift car to stop during emergency.
Endurance	Is a measure of the time during which a material or assembly continues with its ability to provide protection from it.
Engineer	An individual with a degree in engineering from an accredited educational institution.
Entrance Facility (EF)	An entrance facility is a space where telecommunications outside plant terminates to the inside facilities. The outside

	plant will most likely be fiber optics LAN, CATV coax, UTP telephone and MaxCell inner duct.
Entry Delay	A time delay that allows the building owner a period of time before the alarm triggers due to an event.
Escalator	Is a power driven, inclined, continuous stairway used for moving passengers from one level of the building to another.
Escape Door	Means a door in an escape route that leads directly to a street or to any approved open space leading to a street or public place.
Escape Lighting	That part of emergency lighting which is provided to ensure that the escape route is illuminated at all times.
Escape Route	The entire path of travel from the furthest point in any room in a building to the nearest escape door and may include an emergency route.
Evacuation Route	Means the continuous path of travel from any part of a building, to a safe place. It is one that a person needs to traverse before reaching safety.
Evacuation	The act or process of evacuating person in the event of fire or other hazardous materials emergency.
Ex-Filtration	Air that flows outward through a wall, door, window, crack, etc.
Existing Structure	A structure erected prior to the date of adoption of the appropriate code, and one for which a legal building permit has been issued.
Exit Access	That portion of a means of egress system that leads from any occupied portion of a building or structure to an exit.

Exit Delay	This is the delay after an alarm is armed which allows the building owner to exit the home before the system becomes active.
Exit Door	Any door that is a component of an escape route from any room or any door.
Exit	That portion of a means of egress system which is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protective as required to provide a protected path of egress travel between the exit access and the exit discharge. Exits include exterior exit doors at the level of exit discharge, vertical exit enclosures, exit passageways, exterior exit stairways, exterior exit ramps and horizontal exits.
External Wall	An outer wall or vertical enclosure of a building not being a party wall even though it may adjoin a wall of another building.
Facilities for PwDs	Facilities allowing the use of buildings without assistance for any person with a temporally or permanent disability or even external circumstances.
Facility	Means something that is built, installed, or provided to serve a particular purpose. Sensory disability includes visual and hearing impairments or all or any portion of buildings, structures, site improvements, elements and pedestrian or vehicular routes located on a site.
Fan Static Pressure (FSP)	The fan total pressure minus the fan velocity pressure (FSP = FTP – FVP). It can be calculated by subtracting the total pressure at the fan inlet from the static pressure at the fan outlet.

Fan Velocity Pressure (FVP)	The velocity pressure corresponding to the fan outlet velocity.
Feeder Route	That part of an escape route which allows travel in two different directions to the access doors to at least two emergency routes.
Fence	A guard or stop to limit motion.
Fill	Deposition of earth materials by artificial means.
Final Pre-Stress	The stress which exists after substantially all losses have occurred.
Final Tension	The tension in the pre-stressing tendon corresponding to the state of the final pre-stress.
Finger Joint	Joint produced by connecting timber members' end-to-end by cutting profiles in the form of V-shaped grooves to the ends of timber planks or scantlings to be joined, gluing the interfaces and then mating the two ends together under pressure.
Fire Alarm Signal	A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, water flow switch or other device whose activation is indicative of the presence of a fire or fire signature.
Fire Alarm System	A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals or any manually operated system designed to give warning of fire.

	Fire alarm system comprising components for automatically detecting a fire, initiating an alarm of fire and initiating other actions as appropriate
Fire Barrier	A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.
Fire Control Centre	A compartment (situated at street level with direct access to open air and vehicular approach) containing enunciator boards, controls, terminals, etc. of the fire protection and life safety systems within that building/complex.
Fire Damper	A closure which consists of a normally held open damper installed in an air distribution system or in a wall or floor assembly and designed to close automatically in the case of a fire in order to maintain the integrity of the fire separation.
Fire Department Connection	Mean a connection for fire service connection use in supplementing or supplying water for standpipes or sprinkler systems.
Fire Detection Devices	Heat and smoke detectors are the most commonly used fire detection devices. Heat detectors are designed to detect a fixed amount of heat present at the detector or a rapid increase of heat in the area of the detector. Smoke detectors can detect the presence of smoke in an area (when it reached the ceiling where the detector is normally located.)
Fire Detection System	Any system designed to detect automatically the presence of smoke, heat, combustion products or flame and give warning of same.

Fire Detector	A device designed to detect the presence of a fire signature and to initiate action.
Fire Door or Fire Shutter	A door made of fire resisting material, generally metal plated, held open by a fusible link which melts in a fire permitting the door to close, and thus delays or prevents the spread of fire by confining it to one compartment.
Fire Escape	A special kind of emergency exit usually mounted to the outside of a building or occasionally inside but separate from the main areas of the building. It provides a method of escape in the event of a fire or other emergency that makes the stairwells inside a building inaccessible.
Fire Extinguisher	Any of various portable devices used to extinguish the fire by ejection of fire inhibiting substance, such as water, carbon dioxide, gas or chemical foam.
Fire Hose Reel	A collapsible flameproof hose reeled on a drum attached to a water outlet to supply water to extinguish a fire.
Fire hose	Refers to several different types of hoses specifically designed for use in fighting fires.
Fire Hydrant	Pipe of water from main with nozzle for hose.
Fire Partition	Is a vertical assembly of materials designed to restrict the spread of fire and in which openings are protected.
Fire Pump	A pump for fire protection purposes usually driven by an independent, reliable prime mover.
Fire Resistance Rating	Means the period for which a building element or component shall comply with the requirements for stability, integrity and insulation when tested to the fire requirements of approved standards.

Fire Resistance Testing	Determination of the fire resistance rating of any element by exposing it to the standard of fire such that the specimen standard temperature should be achieved in a specified time.
Fire Resistance	Means the shortest period for which a building element or component shall comply with the requirements for stability, integrity and insulation when tested to the fire requirements of an approved standards institution.
Fire Safety Functions	Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of harmful effects of fire.
Fire Stop	A non-combustible barrier or seal to full thickness of a wall or floor which would prevent or retard the passage of smoke or flame within a cavity or around a pipe or duct where it passes through a wall or floor or between elements of structure, and "fire stopped" shall be construed accordingly.
Fire Test	Means the fire resistance tests of elements of building construction.
Fire Wall	Is a fire-resistance-rated wall having protected openings which restricts the spread of fire and extends continuously from the foundation to or through the roof with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.
Flame Spread Index	Comparative measure, expressed without dimension number, derived from visual measurements of the spread of flame versus time for a material.
Flame Spread	The propagation of flame over a surface when item burns.

Flood Sensor	This component detects the presence of excessive water so that it can alert the monitoring station of a potential flood concern.
Floor Area	In relation to building or a storey thereof, means the total area enclosed within its external walls, exclusive of the area occupied by any lift shaft.
Floor Distribution Board (FDB)	A box located in each of the floors of a multi-storeyed building.
Floor	The lower surface in a storey on which one normally walks in a building. The general term 'floor' unless specifically mentioned otherwise shall not refer to a 'mezzanine floor'.
Flooring	Upper layer of a floor providing a finished surface.
Fly Screen on a Vent Pipe	A screen which prevents flies from entering the pit and which also prevents flies that have entered the pit from leaving through the vent pipe.
Formwork	Is temporary structure done for the support of the reinforced concrete while it is being poured in-situ. It is provided to contain fresh concrete and support it in the required shape and size until it has hardened.
Foul Water	Means either water-borne human or animal excrement or industrial solids or waste water conveyed in underground pipes.
Foundation	That part of the structure which is in direct contact with and transmits loads to the ground.

Freehold	Type of land tenure granting full and indefinite rights over the land.
French Drain	A trench filled with suitable material which is used for the disposal of liquid effluent from a septic tank or waste water.
Fresh Air	Normal outdoor air not unduly affected by odors, smoke, effluents, dust, fumes, discharges from mechanical plants and the like.
Fuse Switch	A composite unit, comprising a switch with the fuse contained in, or mounted on. The moving member of the switch.
Fuse	A device that, by the fusion of one or more of its specially designed and proportioned components, opens the circuit in which is inserted when the current through it exceeds a given value for a sufficient time.
G+0	Ground floor or single storey.
Garage	A frame erected on side supports so as to span an area and support and hoist machinery and heavy materials. Any premises or part thereof- Used for repairing, painting, washing, storing, housing or parking of motor vehicles; or Where a pump is maintained from which petrol or oil is supplied to motor vehicles.
Glass break Sensor	This component detects the sound or vibration from shattering glass to trigger alarm.
Glazing	Cutting and fitting panes of glass into frames.

Glued Laminated Timber	It is a type of structural timber product comprising of a number of layers of dimensioned timber bonded together with durable, moisture-resistant structural adhesives.
Goods Lift	Is a lift designated mainly for the transport of goods, but which may carry a lift attendant or other persons necessary for the loading or unloading of goods.
Grade of Concrete	Rating of concrete according to its mix ratio and its compressive strength determined by the crushing test.
Green Building Concept	Green building (also known as green construction or sustainable building) refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle.
Grille	A louvered or perforated covering for an air passage opening which can be located in the side-wall, ceiling or floor.
Ground Level	Horizontal plane on the earth's surface.
Ground Storey	A storey the floor level of which is not more than 1m at any point below the level of the adjacent finished ground level, or, if there are two or more such storeys, the lower or lowest of them.
Ground	Small section, usually of timber, to which a skirting, architrave, door lining or similar are fixed and which may also be used as an edging for plastering.
Guard	Is a protective barrier around openings in floors or at the open sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations to prevent accidental openings through it.

Handrail	Is a rail that is designed to be grasped by the hand so as to provide stability or support.
Hardwired System	This is a system that is installed using physical wires, often hidden mostly behind the walls of the home.
Hazardous Wastes	are wastes produced in the industries, institutes, hospitals and laboratories., that are dangerous to the living organisms immediately or in the long run to the environment in which they are disposed.
Heat Detector	This alarm component detects extreme or rapid changes in heat within an area of the home as a detector for fire.
Heaters	appliances whose purpose is to generate heat for building.
Highway	the part or parts of the road open to automobile traffic, that part of the road may have other different parts of road separated by central reservation;
Horizontal Assembly	A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.
Hose Reel	Is a cylindrical spindle made of metal, fibber glass, or plastic and is used for storing a hose.
Hot Water Tanks	a vessel for storing hot water under pressure greater than the atmospheric pressure.
Humidity, Relative	The ration of the mole fraction of water vapour present in moist air to the mole fraction of water vapour in saturated air at the same temperature and pressure.
Hybrid Alarm System	This is a building security system that utilizes both hardwired and wireless components.

Image Sensor	A motion sensor with a built-in camera that can send photos captured when the motion sensor is triggered to the interactive smart device.
Impact Load	The load resulting from moving machinery, elevators, crane ways, vehicles and other similar forces and kinetic loads, pressure and possible surcharge from fixed or moving loads.
Impact Noise	Sound created when a building surface is struck by an object.
Incineration	Is a chemical reaction in which carbon; hydrogen and other element in the waste combined with oxygen in the combustion zone and generates heat.
Incremental Building	To be constructed in stages in such a manner that in its intermediate stages a building can be occupied for the limited specified period of time necessary to complete it and that is intended, in its finally approved form.
Industrial Effluent	Any liquid whether or not containing matter in solution or suspension which is given in the course of or as a result of any industrial, research or agricultural activity, and includes any liquid other than soil water or storm water.
Infiltration	Air that flows inward through a wall, door, window crack, etc
Initiating Device	It is system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box or supervisory switch.

Inspection	Consists of the visual and technical examination of any construction site and the production of a report that outlines the 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.
Inspector	Is a person designated by the Competent Authority to carry out building activities inspection in accordance with this Code and is deemed to satisfy the requirements of professional bodies recognized by the law.
Installer Programming	Refers to the ability of the installer (who may also be the building owner who self-installs an alarm system) to set characteristics of the security system that customize and configure it according to the home or business.
Institute of Architects	Professional organization of architects tasked with supervising compliance by its members with the rules governing the profession.
Institute of Engineers	Professional organization of engineers tasked with supervising compliance by its members with the rules governing the profession.
Insulating Material	Material for preventing or reducing the passage of heat, sound or electricity.
Insulation	Suitable non-conducting material, enclosing, surrounding or supporting a conductor, Usually PVC, polymer, specially treated rubber.

Interior Floor Finishes	Exposed floor surfaces of building (s) together with coverings applied over a finished floor or stair, as well as risers.
Joint	A connection between two or more bamboo structural elements.
Kerb or Curb	a. The stone, concrete or tile edging which separates a pavement or sidewalk from a road surface. b. Also the molded member that borders the front of a fireplace.
Keypad	Also referred to as a touchpad, the key pad of a building alarm system is the numbered pad on the system that allows for the homeowner to arm, disarm and otherwise communicate with the alarm system.
Ladder	Steps consisting of two parallel members connected by rungs; for climbing up or down
Laminated Veneer Lumber	A structural composite made by laminating veneers, 1.5 mm to 4.2 mm thick, with suitable adhesive and with the grain of veneers in successive layers aligned along the longitudinal (length) dimension of the composite.
Land Reserves	Land set aside by public authorities for future development needs.
Land Subdivision	The planning operation aimed at dividing a plot of land into more than two serviced sites destined for settlement and/or related activities.

Land Title	A written document confirming a person's rights to land, which is governed by written laws and delivered according to the law by a competent authority. It applies to the emphyteutic lease as well as to the freehold, or any other form of land tenure legally provided for.
Lateral Load	Loads that are caused by wind, earthquakes and other dynamic forces.
Lease Contract	The document of official information on the characteristics of a plot of land and existing constraints on it, in the form of a contract concluded between the land owner and the administration.
Legionella:	The motile aerobic rod-shaped Gram-negative bacterium that thrives in central heating and air conditioning systems and can cause Legionnaires' disease.
Lift	Is an electrical device designed to transport persons or materials between two or more levels in a vertical or significantly vertical direction by means of a guided car .The word ‘elevator’ is also synonymously used for ‘lift’.
Lift Car	Is the load carrying unit with its floor or platform, car frame and enclosing bodywork.
Lift for Person with Disabilities	Lift for persons with physical disabilities” means an elevating device, whether portable or fixed, that travels between fixed points of a building or structure, that is restricted as to access, speed, travel and type of operating device, and that is specifically designed for use by persons with physical disabilities.

Lift Pit	Is the space in the lift well below the level of the lowest lift landing served.
Lift Well	Is the passable space within an enclosure provided for the vertical movement of the lift car(s) and any counterweight(s), including the lift pit and the space for top clearance.
Lift Well Enclosure	Is any structure which separates the lift well from its surroundings.
Lighting Fittings	A device for supporting or containing a lamp or lamps (for example, fluorescent or incandescent) together with any holder, shade, or reflector; for example, a bracket, a pendant with ceiling rose, or a portable unit.
Lining, Duct	Duct lining including materials such as adhesive, insulation, coating and film used to line the inside surface of a duct, fan casing, or duct plenum.
Live Loads (Imposed Loads)	Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.
Live	Electrically charged so as to have a potential different from that of earth.
Load Bearing Wall	Means a wall primarily designed to carry an imposed vertical load in addition to its own weight.
Load Effects	Forces and deformations produced in structural members by the applied loads.

Load	Any force to which a building is or may be subjected, and includes dead, imposed, wind and seismic loads and forces caused by dimension changes of materials.
Lobby	A large entrance, reception room, or waiting area.
Local Materials	Available on or near the site for construction including stone and granite, mud or clay stabilized with rice straw, corral ash and/or cement dust to improve resistance to erosion and structural properties.
Lumen (lm)	SI unit of luminous flux. The luminous flux emitted within unit solid angle (one radian) by a point source having a uniform intensity of one candela.
Luminaire	A complete light fitting consisting of lamp, holder, starting gears, reflectors, housing and mounting accessories.
Main Distribution Board (MDB)	It is the distribution box where the main incoming cable enters and terminates from the main service feed connection of a large building.
Main Distribution Frame Room	A room within a building or development that is used to house a main distribution frame licensees' installation or plant.
Main Distribution Frame	The frame on which incoming main cables and the local distribution cables within a building or development are terminated and cross-connected.
Maintenance Management	The organization of maintenance within an agreed policy. Maintenance can be seen as a form of 'steady state' activity.

Manhole	A chamber of a depth greater than 750mm and of such dimensions that allows entry of a person into such chamber for the purpose of providing access to a drain.
Market Value	Estimated amount for which a property should exchange on the date of valuation.
Masonry	A construction of stone or similar materials such as concrete blocks or brick.
Master Code	A master code is the main code used for an alarm system that the homeowner uses to arm and disarm the home security system.
Means of Egress	A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way a means of egress consists of three separate and distinct parts: the exit access, the exit and the exit discharge.
Medical Waste	Wastes from health posts, clinics, hospitals, pharmaceuticals, and other medical facilities.
Member	Means a structural component such as a beam, joist, column, slab, or foundation.
Membrane Covered Cable Structure	A no pressurized structure in which a mast and cable system provides support and tension to the membrane weather barrier and the membrane imparts stability to the structure.
Memorial Sites	Sites or building erected for commemoration to honour genocide victims.
Memorial	A monument, marker, tablet, headstone, tombstone, private mausoleum.

Memory	As with other electronic devices, alarm systems can have built-in memory.
Mobile Crane	Is hydraulic powered crane with a telescoping boom mounted on truck type carriers or a cable controlled crane mounted on crawlers.
Mosaic Flooring	Panels comprising squares assembled from softwood or hardwood fingers held together by a removable surface membrane or fixed flexible backing.
Motion Sensor	These usually detect motion based on body heat in a 90-degree angle and generally up to 15 away.
Multiple-Station Alarm Device	These are two or more single-station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate. It can also consist of one single-station alarm device having connections to other detectors or to a manual fire alarm box.
Natural Ventilation	Supply of outside air into a building through window or other openings due to wind outside and convection effects arising from temperature or vapour pressure differences (or both) between inside and outside of the building.
Noise Reduction (NR)	Noise Reduction (NR) is a general term for specifying sound insulation between rooms. It is more general than Transmission Loss (TL). If all boundary surfaces in the receiving room are completely absorbent, the NR will exceed the TL by about 5 dB, i.e. NR = TL + 5dB.
Noise	Unwanted sound which may be hazardous to health.
	Noise that interferes with communications or is disturbing.

Nominal Cross-Sectional Area	The cross sectional area equivalent to the area of a circular plain bar of nominal diameter.
Non-Load Bearing Wall	A wall which supports no load other than its own weight.
Non-Structural Wall	A wall which does not form part of a structure but which may from time to time be subjected to forces other than its own weight.
Obnoxious Substances	Substances which are highly offensive; odious.
Obstruction	Any building or other object which partially or completely intersects any zone of space serving a window but shall not include any narrow object such as a pole or railing which does not materially obstruct the entry of light and air to the opening concerned.
Occupancy	The particular use or to which a building or portion thereof is normally put or intended to be put.
Occupation Certificate/Permit	The document/A permit issued by the building consent authority to authorise the use of the building by certifying conformity of buildings with urban planning and building regulations and with the building permit.
Opening Protective	A device installed over an opening for protecting it against the passage of flame, smoke, or hot gases.
Other Conditions	All other conditions of this code apply to risk zones except where specifically stated.
Outdoor Air	Ambient air entering the system or opening from outdoors before any air treatment.
Over-Current	A current exceeding the rated current for conductors, the rated value is the nominal current carrying capacity.

Pail Closet	Closet with a removable pail which is systematically emptied or replaced.
Panel	The panel of a home alarm system is the box or "can" that contains all of the components of the building alarm system such as the backup battery and the main circuit board.
Parapet Wall	The part of any wall entirely above the roof line.
Partition Wall	Means a non-structural internal wall extending to the ceiling and constructed for the purpose of subdividing a space.
Partition	Is a non-structural interior construction not more than one storey in height, and generally of lightweight materials, and may or may not be demountable.
Party wall or Separating Wall	Means a wall forming part of a building, and standing on land of different owners.
Passenger Lift	Is a lift designed for the transport of passengers.
Pedestrian Walkway	Means a walkway used exclusively as a pedestrian traffic way.
Permissible Stress	Stress obtained after applying factor of safety to the ultimate or basic stress.
Permitee	Any individual, private or public entity that has received authorization for new development, refurbishment with or without alteration, renovation, occupation, change of building use or demolition of a building. And for the purposes of this Code the permittee shall mean the owner.

Persons with Disabilities	A person who has a loss, or a reduction, of functional ability and activity and includes a person in a wheel chair and a person with a sensory disability
Pile	A slender deep foundation unit made of materials such as steel, concrete, wood that transmits the load to the ground by skin friction, end bearing and lateral soil resistance.
Pipe Fitting	Component fitted to a pipe for such purposes as connecting, controlling, supporting, or changing its direction or bore.
Pipeline	A line of pipe connected to valves and other control devices, for conducting fluids, gases or finely divided solids.
Pit Latrine	Closet placed over, or adjacent to, an excavation which is of adequate depth.
Place of Safety	An enclosed space in the open-air ground level; or at ground level having sufficient final exits.
Plain Concrete	Concrete in which no reinforcement is included for the structural purposes but in which reinforcement may be provided for the purpose of restraining shrinkage or other movement.
Plenum Chamber	An air compartment connected to one or more distributing ducts
Plot Ratio	The ratio of the total area of all floors of a building to the area of the site it occupies.
Plot	The parcel of land which belongs or will belong exclusively to the building and any ancillary structure.

Plug	A device carrying metallic contacts in the form of pins intended for engagement with corresponding socket contacts and arranged for attachment to a flexible cord or cable.
Plumbing	The business, trade or work having to do with the installation, removal, alteration or repair of plumbing and drainage systems or part thereof
Plywood	A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.
Portable Fire Extinguisher	Is an active fire protection device used to extinguish or control small fire, often in emergency situation.
Portable	Any fire service equipment which manufactured, used or designed to be hand operated.
Position and/or Direction Indicator	Is device which indicates on the lift landing or in the lift car or both, the position of a car in the lift well or the direction or both in which the lift car is traveling.
Post-Tensioning	A method of pre-stressing concrete in which pre-stressing steel is tensioned against the hardened concrete.
Pour Flush Toilet	Pour flush toilets use a plastic, fiberglass, or cement bowl or squatting pan set into a concrete platform.
Precast Concrete	A construction product produced by casting concrete in a reusable mold or "form" which is then cured in a controlled environment, transported to the construction site and lifted into place.

Prefabricated Building	The partly or fully assembled and erected building of which the structural parts shall consist of prefabricated individual units or assemblies using ordinary or controlled materials including service facilities and in which the service equipment may be either prefabricated or constructed in-situ.
Prefabricated Concrete	Concrete members which are cast away from the site.
Pre-stressed Concrete	Concrete in which permanent internal stresses are deliberately introduced, usually by tensioned steel, to counteract to the desired degree the stresses caused in the member in service.
Pre-Stressing	This is the process by which compression stresses are induced in some parts of unloaded structure, so that tensile stresses which are subsequently caused by loading; may be counter balanced and eliminated.
Pre-Tensioning	A method of pre-stressing concrete in which the tendons are tensioned before concreting.
Project Cost	the sum to be expended in constructing the building including the foundations, structural frame, and finishes and the installation of building services.
Property	A piece of land, often with buildings on it, that is owned by a person.
Protected Buildings	Buildings classified as a natural and architectural heritage for their protection.
Public Building	Building intended to be used by many people because of various activities carried out therein. Those include shops,

	schools, hospitals, buildings for entertainment and public assembly, churches, mosque, chapel, temple or other places of worship or religious ceremonies
Public Property	Property which is dedicated to the use of the public.
Public Sewer	Means any sewer vested in the control of a public body.
Public Way	A Street, alley or other parcel of land open to the outside air leading to a street that has been deeded, dedicated or otherwise permanently appropriated to the public for public use.
Purlin	Beam parallel to the eaves giving support to roof cladding.
Qualified Person	A registered professional with a minimum of three years post registration experience in the built environment.
Rafter	A sloping timber joist extending from the wall plate to the ridge of the roof, directly or indirectly supporting the roof.
Rainwater	Water resulting from precipitation as collected from buildings or structures.
Ramp	Sloping surface joining two different levels, as at the entrance or between floors of a building. General, it is inclined surface or roadway connecting different levels.
Rated Load (Escalator)	The load for which the escalator is designed and installed to lift at the rated speed.
Rated Load (Lift)	The maximum load for which the lift car is designed and installed to carry safely at its rated speed.

Rated Speed (Escalator)	The speed at which the escalator is designed to operate. It is the rate of travel of the steps, measured along the angle of inclination, with rated load on the steps or carriage.
Real Property	Immovable property including land, buildings, fences, foundations and all other improvements made to the land.
Recycling	The act of collecting, reprocessing, and/or recovering certain waste materials to make new materials or products. The non-biodegradable materials like paper, plastics, metals, glass and wood are commonly recycled in useful materials.
Refrigerant	The fluid used for heat transfer in a refrigerating system, which absorbs heat at a low temperature and low pressure of the fluid and rejects heat at a higher temperature and higher pressure of the fluid, usually involving changes of state of the fluid.
Regular Structure	A structure is "regular" if the distribution of its mass, strength, and stiffness is such that it will sway in a uniform manner when subjected to ground shaking – that is, the lateral movement in each storey and on each side of the structure will be about the same.
Reinforced Concrete	Concrete which contains reinforcement, normally of steel, to improve its resistance to tension, the materials of which comply with the relevant provisions contained in the Rwanda Building Code.
Rendering	The application of mortar or plasterwork by means of a float or trowel.

Residential Building	A building or part thereof designed or adapted or used for human habitation. This includes and any outbuilding and other covered structure which are intended for the enjoyment of the occupants of the building or part thereof or.
Resistances Factor	A factor that accounts for deviations of the actual strength from the nominal strength and the manner and consequences of failure.
Retaining Wall	Wall providing lateral support to the ground or designated to resist pressure from a mass of other material.
Retractable Awning	A cover with a frame that retracts against a building or other structure to which it is entirely supported.
Reverberation	The continuation of an audible sound in an enclosed space after the sound source has been cut off.
Roof Assembly	A building cover and its supporting structure including any ceiling attached to such a structure.
Roofing	Upper layer or layers of a roof providing weatherproof surface.
Roof Light	Construction for closing an opening in a roof intended primarily for lighting and consisting of a frame and glazing.
Ruggedness	A property of some mechanical and electrical equipment and other non-structural building components that permits these items to remain functional after experiencing strong shaking.

Safety Shower	A piece of equipment designed to wash any chemicals that may have come into contact with toilet.
Sanitary Fittings	Appliances and pieces used in connection with water supply, drainage and sanitation.
Sanitary Group	A combination of sanitary fixtures comprising not more than one of each of a WC pan, bath, shower and sink and either two washbasins or one washbasin and one bidet.
Sanitation Accommodation	A space containing one or more closets or urinals. Sanitary accommodation containing one or more cubicles counts as a space if there is free circulation or air throughout the space.
Scaffold	A temporary arrangement erected around a building for convenience of workers.
Screed	Layer or layers of screed material laid in situ, directly onto a base, bonded or unbounded, or onto an intermediate layer or insulating layer, for one or more of the following purposes: to obtain a defined level; to carry the final flooring and to provide a wearing surface.
Secondary Material	Used materials which have already undergone a process of transformation; such as demolished building materials turned into aggregate.
Security System	The term "security system" is used interchangeably with the term "alarm system" and refers to all components of the system that protect the building.
Seepage or Soak Pit	A covered pit dug in the ground in which effluent from the septic tank is discharged.

Septic tank	watertight tank designed to receive sewage and to retain it for a determined period to secure adequate decomposition of sewage.
Service Lift	A passenger goods lift meant to carry goods along with people.
Sewage	wastewater, soil water, industrial effluent and other liquid waste flowing in separate or combined sewer, but shall not include storm water.
Sewer	A pipe or conduit which is the property of or is vested in the local authority and which is used or intended to be used for the conveyance of sewage.
Sheet Piling	A line of piles driven in the soil to create a barrier or retaining wall.
Single skin	Where there is only the single outer skin and the air pressure is directly against that skin.
Site plans	Plans used to locate the position of buildings in relation to setting out point, means of access, general layout of site. The plans may also contain information on services drainage network.
Slip Form	A continuously moving form at such a speed that the concrete when exposed has already achieved enough strength to support the vertical pressure from concrete still in the form as well as to withstand nominal lateral forces.
Slug Soak Pit	Pit in which sewage effluent from the house drain is directly discharged.
Smoke Alarm	A single or multiple station alarm responsive to smoke.

Smoke Barrier	Membrane either horizontal or vertical like floor, walls, or ceiling assembly that is designed to restrict to the movement or spread of smoke.
Smoke Control System	A combination of fans, dampers, warning devices and other equipment that work together to perform the control function for any smoke event at any location in a building.
Smoke Damper	A device installed in ducts openings to resist the passage of smoke.
Smoke Detector	A device that senses visible or invisible particles of combustion.
Smoke Developed Index	Comparative measure which is expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material.
Smoke Partition	A designed continuous membrane forming a barrier to oppose the air duct: A pipe, tube, conduit or enclosed space to use or to be used in any building for the transmission of air or liquid from one place to another.
Smoke Proof Enclosure	An exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.
Smoke	Dispersions of finely divided or liquid in gaseous medium.
Solid Waste Management Disposal	The final stage in the solid waste management, with all the wastes whether they are residential, commercial or from any other sources are collected and transported to a disposal site.

Solid Waste	The unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given building.
Sound Insulation	The prevention of the passage of sound.
Sound Power	The acoustic power of a sound source, expressed in decibel
Sound Pressure	Root-mean-square value of the variation in air pressure caused by the sound, measured in Pascals (Pa), above and below atmospheric pressure, caused by the sound.
Sound Source	Equipment or phenomena which generate sound. Source room is the room containing sound source.
Sound	A vibration disturbance, exciting hearing mechanisms, transmitted in a predictable manner determined by the medium through which it propagates.
Spaced Column	Refers to two column sections adequately connected together by glue, bolts, and screws or otherwise where the adequate protection is required and design measures have initially been incorporated to render the structure serviceable for the required life.
Split	A crack extending from one face of a piece of wood to another and runs along the grain of the piece.
Sprinkler system	System of piping and sprinklers connected to a water supply, which, when actuated by the effect of fire, automatically releases water.
Stacker cranes	Cranes with a forklift type mechanism used in automated warehouses.

Stairs	A term applied to a complete flight of steps between two floors.
Stairway	Is any component of a building that offers ascending or descending route of travel formed by a single flight or by a combination of two or more flights and one or more intervening landings.
Standpipe Systems	Mean an arrangement of piping, valves, hose outlets and related equipment installed in a building or structure, for the purpose, of extinguishing a fire through the discharge of water in streams or sprays from hoses or nozzles attached to such outlets. The water shall be supplied from water supply systems or by pumps, tanks and other equipment necessary to provide adequate supply of water to the outlets.
Storey	That part of a building which is situated between the top of any floor and the top of the floor next above it, or if there is no floor above it that portion between such floor and the ceiling above it (mezzanine floor, open work floor, catwalk or gallery being taken to be part of the storey in which it is situated), and in relation to a building: a. the ground storey shall be taken as the storey in which there is situated an entrance to the building from the level of the adjoining ground or, if there is more than one such storey the lower or lowest of these; b. a basement storey shall be taken to be any storey of the building which is below the level of the ground storey; c. an upper storey shall be taken to be any storey of a building which is above the level of the ground storey; d. the height expressed in storeys shall be taken to be that number of storeys other than a basement.

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Storm Water Drain	A pipe, conduit or surface channel, which is used solely to convey storm water.
Storm Water	Water resulting from natural precipitation and includes rainwater, surface water, sub-soil water or spring water.
Street	A road lined with buildings (or so intended) including avenues, crescents, cul-de-sacs, alleys, closes, courts, places, lanes and drives.
Structural	Relating to or forming part of any structural system.
Structural Addition	Any addition made to the existing layout of space in a structure that requires adding walls or joining a structure to the one which existed previously.
Structural Alteration	Any change, addition or modification in the design, construction, use or occupancy of any building or structure; or parts thereof ; or of any appliance or building service equipment in the building or structure.
Structural Grades	Grades defining the maximum size of strength reducing natural characteristics (knots, sloping grain, etc.) deemed permissible in any piece of structural timber within designated structural grade classification.
Structural Members	Masonry units or supports that are constituent part of any structure or building or various assemblies of structural material including walls, columns, partitions, beams slabs, girders, linters and other units of structural systems and resist on the load acting up on them.

Structural Repair	Operations on a building to restore it to an identical condition as to appearance, structure, and occupancy that existed before such operations became necessary whether caused by fair wear and tear or by accident;. repairs shall not include the complete replacement of a building previously destroyed.
Structural System	The system of constructional elements and components of any building that is provided to resist the loads acting upon it and to transfer such loads to the ground upon which such building is founded.
Structural Timber	Timber in which strength is related to the anticipated in-service use as a controlling factor in grading and selection and/or stiffness.
Structural wall	A wall forming part of any structural system.
Structure	A fabric or framework of material parts which is built or constructed; An edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.
Switch	A manually operated device for closing and opening or for changing the connection of a circuit.
Switch Board	An assemblage of switchgear with or without instruments; the term, however, does not apply to a group of local switches on a final sub circuit where each switch has its own insulating base.
Switch Gear	Main switches cut outs or fuses, conductors and other apparatus in connection therewith, used for the purpose of

	controlling or protecting electrical circuits or machines or other current using appliances.
Symbolic Safety Signs	Symbols and signs displayed to caution against hazards.
Systems Building	A method of building in which prefabricated components is used to speed up the construction of buildings.
Telecom Equipment Room	Room within building or a development that is used to house a licensee's installation, plant or system.
Telecommunication Riser	A compartment that is used to house and distribute telecommunication cables to the individual stories of a building.
Temperature, Dry-bulb	The temperature of a gas or mixture of gases indicated by an accurate thermometer shielded from effects of radiation.
Temperature, Mean radiant	The temperature of a uniform black enclosure in which a body or occupant would exchange the same amount of radiant heat as in the existing non-uniform environment.
Temperature, Operative	Arbitrary index that combines into a single number the effects of dry-bulb temperature, radiant temperature and air motion on the sensation of warmth or cold by the human body. The operative temperature can be taken as average of mean radiant temperature and dry-bulb temperature.
Temperature, Wet-bulb	Thermodynamic wet-bulb temperature is the temperature at which water (liquid or solid state), by evaporating into

	air, can bring the air to saturation adiabatically at the same temperature. Wet-bulb temperature (without qualification) is the temperature indicated by a wet-bulb psychomotor, constructed and used according to specification.
Temporary Building	Building which were built in temporary consent with land owner and Building Consent Authority while agreeing on the characteristics, the temporary nature of the Building and its use. When removed or demolished no compensation is paid to the owner.
Tendon	A steel element, such as a wire, cable, bar, rod or strand, or a bundle of such elements used to impart pre-stress to concrete when the element is tensioned.
Tenement House	Any building in the domestic part of which any living room is intended or adapted for the use of more than one tenant or sub-tenant. In this regulation "living room'1 means room intended or adapted as a place for cooking and or sleeping.
Terrace	An enclosed level platform often fitted with a balustrade, in front of a house; a gallery or a balcony attached to a house.
Tile	Is a manufactured piece of hard-wearing material such as ceramic, stone, metal, or even glass, generally used for covering roofs, floors, walls, showers, or other objects such as table tops.
Timber	Both sawn and unsawn logs and all other forms of and wood deposited for purposes of trade or manufacture,

	other than timber intended for use as firewood, and include wooden furniture.
Toilet	A room in which water, earthen chemical closet and/or urinals and wash basins are installed**.**
Transmission Length	The distance required at the end of a pre-tensioned tendon for developing the maximum tendon stress by bond.
Treated Wood	Wood impregnated under pressure with compounds that reduce its susceptibility to flame spread or to deterioration caused by fungi, insects or marine borers.
Trench	Any excavation in the ground where the depth of the excavation exceeds the width.
Trim	Handrails, chair rails, picture moulds, baseboards, door and window frames and similar decorative or protective materials used in fixed applications.
Tunnel Form	A system which casts walls and slab together like a portal in a single pour.
Urban buildings	Buildings in urban centres as defined by the law governing urban planning and building.
User Programming	Refers to the ability of the homeowner to set behavioral characteristics of the building security system.
Vapour barrier	A moisture-impervious layer applied to the surfaces enclosing humid space to prevent moisture travel to a point where it may condense due to low temperature.
Vent	A ventilating pipe.

Ventilated Improved Pit Latrine	An improvement of a standard pit latrine with ventilation intended to eliminate odours (and consequently flies).
Ventilating pipe	A pipe which leads to the open air at its highest point and which provides ventilation for the purpose of preventing the destruction of water seals, but does not include a discharge pipe.
Ventilation	The process of supplying or removing air, by natural or mechanical means, to or from any space.
Ventilator	A device with an adjustable aperture for regulating the flow of fresh or stagnant air.
Veranda	An open portico or roofed gallery extending along the front (and occasionally, other sides) of a dwelling or other building, erected chiefly as a protection or shelter from the sun or rain.
Voice Dialer	This component will automatically call in to telephone numbers that are programmed into the system. After calling the numbers, the voice dialer will play a recorded message (or a live person will be on the line) once the home alarm system has been triggered to notify the individual answering the number of the event that has been triggered.
Walkway	A path set aside for walking.
Wall	a vertical load-bearing or non-load-bearing member of a structure whose length exceeds four times its thickness.
Warehouse	A building where storage is the principal use and where no business is transacted other than incidental to such storage.

Waste Pipe	Pipe which receives the waste from appliances such as baths, sinks (not being slop-sinks), bidets or lavatory basins.
Water Closet	latrine accommodation used with waterborne system of excreta disposal.
Water Heater	Any heating device that heats clean water and supplies it to the potable hot water distribution system.
Water Main	the principal artery of the system, to which branches may be connected for the purpose of water supply to individual consumers.
Water Supply System	A system consisting of building water supply pipe, water distributing pipes, and necessary connecting pipes, fittings, control valves, and all appurtenances carrying or supplying potable water in or adjacent to the building or premises.
Wave Actions	Wave actions caused by water waves propagating over the water and striking a building or other structure must be determined using engineering principles. Wave actions include wash and wind generated waves.
Wearing Screed	A screed that serves as flooring.
Wet Riser	Is a system of valves and pipe work which are kept permanently charged with water.
Wind Load	All loads due to the effect of wind pressure or suction.
Window	Construction for closing a vertical or near-vertical opening in a wall or roof that will admit light and may admit air.

Wired Glass	Annealed glass containing a wire mesh which is completely embedded in the body of the glass during manufacture.
Wood Structural Panel	A panel manufactured from veneers, wood strands or wafers or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems.
Wooden Disc Dowel	A circular hardwood disc generally tapered each way from the middle so as to form a double conical frustum.
Workability	Relating to the physical parameters of concrete which affects the strength and durability as well as the cost of labor and appearance of the finished product. Concrete is said to be workable when it easily placed and compacted homogeneously without bleeding or segregation.
Workshop	Building or a space within a building that serves as a work place for a particular manual activity.
Zone Space	Volume of open air outside an opening relating to an external wall or a portion of such an opening.
Zone	A space or group of spaces within a building with cooling requirement sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device**.**
Zoning Maps	These are plans and maps that are produced to guide the sustainable development in a specific direction of an area.

ACRONYMS AND ABBREVIATION

%	Per cent
°c	Degrees Celsius
A/PM	Ante/Post Meridiem
AAC	Autoclaved Aerated Concrete
AC	Air Conditioning
AC	Alternating Current Power
ACH	Air Changes per Hour
ACI	American Concrete Institute
BDF	Building Main Distribution Frame
CCTV	Closed Circuit Television
Chap	Chapter
CLSM	Controlled Low-strength Material
cps	Cycles per second
CRF	Critical Radiant Flux
CV	Constant volume
dB	Decibels
D.B	Distribution Board
DFE	Defined Flood Event
DFL	Defined Flood Level
D_W	Weighted Level Difference.
e.g.	For example
Ecosan	Ecological Sanitation
ECC	Earth continuity conductor
EF	Entrance facility
EIA	Environmental Impact Assessment
EMI	Electromagnetic interference
EPN dB	Effective Perceived Noise Level in Decibel.
ER/TR	Equipment Room/Telecommunication Room
etc	Et Cetera
FDC	Fire Department Connection
FHL	Flood Hazard Level
FSP	Fan Static Pressure
FTP	Fan Total Pressure
FVP	Velocity Pressure
GFA	Gross Floor Area
GoR	Government of Rwanda
HBN	Health building notes
Hrs	Hours

HVAC	Heating Ventilation and Air Conditioning
Hz	Hertz
IBCCDS	In-building Coaxial Cable Distribution System.
ICT	Information Communication &Telecommunication
IDF	Intermediate Distribution Frame
IEC	International Electro technical Commission
IER	Institute of Engineers Rwanda
IRPV	Institute of Real Property Valuers
IS0	International standards organization
ITCZ	Inter Tropical Convergence Zone
ITU	International telecommunication union
kg/m^3	Kilogramme per metre cubic
kN/m^2	Kilo Newton Per Meter Squared
kVA	Kilovolt Ampere.
L/min	Litre per minute
L/s per m^2	Litre per second per meter squared.
$L_{Aeq\ .T}$	Equivalent Continuous Weighted sound Pressure Level
LA_{max}	Maximum Noise Level
LED	Light Emitting Diode
L_i	Impact Sound Pressure Level
Liter/sec/m^2	Litre per second per meter squared.
LP_A	Weighted Sound Pressure Level
LPG	Liquefied petroleum gases
m	Meter.
m^2	Meter squared.
m/s	Meter per second.
m^2/h per m^2	Meter squared per hour per meter squared.
mA	Milli Ampere
MCB	Miniature Circuit Breaker
mm	Millimeter
mm^2	Millimeter squared
N/mm^2	Newton per millimeter squared
NA	Not Applicable
NC	Non-combustible material only
SP	Protected by a sprinkler system
USP	Not protected by a sprinkler system.
NEC	Noise Exposure Categories
NEF	Noise Exposure Forecast
NP	Not Permitted.

NRC	Noise Reduction Coefficient
Pa	Pascal
P_A	Weighted Sound Pressure.
PDEC	Passive Down draught Evaporative Cooling
ppm	parts per million
PSV	Passive Stack Ventilation
PV	Photo Voltaic
PVC	Polyvinyl chloride
RCD	Residual Current Device
RF	Radio frequency
RHA	Rwanda Housing Authority
RIA	Rwanda Institute of Architects
RBC	Rwanda Building Code
RS EAS	Rwanda Standard East African Standard
RS ISO/TS	Rwanda Standard International Standard Organization/Technical Specification
RSB	Rwanda Standards Board
Sect	Section
S/N	Serial number
SIL	Speech Interference Level
SPD	Surge Protective Device
sqm	Square metre
TER	Telecommunications Equipment Room
TIA/EIA	Telecommunication Industries associations/ Electronic Industries Alliances
V	Volt
VAV	Variable Air Volume
VIP	Ventilated Improved Pit
Watts/cm^2	Watts per centimeter squared
WC	Water Closet

SECTION 3: REFERENCE STANDARDS

STANDARDS	DESCRIPTION	Chap. Part. Sect.
RS 114-2	Structural design — Part 2: Actions on structures — Wind actions,	2.6.2
RS 114-1	Structural design —Part 1: Actions on structures — Densities, self-weight, imposed loads for buildings	2.6.2
RS 112	Basis of Structural Design	2.6.2
ISO 3010	Basis for design structures: seismic actions on buildings	2.6.2
RS ISO 2103	Loads due to use and occupancy in residential and public buildings	2.6.2
RS 106	Loading for building — Code of practice for dead and imposed loads	2.6.2
RS EAS 131-1	Concrete—Part 1: Specification, performance, production and conformity	2.6.3
RS ISO 14688-1	Geotechnical investigation—identification and description	2.6.3
RS ISO/TS 17892-10	Geotechnical investigation—direct shear test	2.6.3
RS ISO/TS 17892-4	Geotechnical investigation—determination of particles and size distribution of soil.	2.6.3
ISO 2394	General principles on reliability for structures	2.6.3
RS ISO 22476-2	Geotechnical investigation and testing —Field testing —Part 2: Dynamic probing	2.6.3
RS ISO 22476-3	Geotechnical investigation and testing —Field testing —Part 3: Standard penetration test	2.6.3
ISO 2394	General principles on reliability for structures	2.6.3
RS 113	Geotechnical design —general rules	2.6.3

RS EAS 134	Cold rolled steel sections — Specification	2.6.4
ISO 17959	General requirements for solid wood flooring	2.6.4
ISO 17959	General requirements for solid wood flooring	2.6.4
ISO 10721-21	Steel structures: Part 1— Material and design	2.6.4
RS ISO 4948	Steel—Classification —Part 1:Classification of steels into unalloyed and alloy steels based on chemical composition	2.6.4
RS 142	Design for concrete structures— code of practice.	2.6.4
RS 211	Methods of test for mortar for masonry	2.6.5
RS 108	Mortar for masonry specification	2.6.5
ASTM C76M - 14	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe	2.6.5
ISO 1182	Reaction to fire tests for products-non combustibility test	2.6.7
ISO 16670	Timber structures—Joints made with mechanical fasteners	2.6.7
RS 108	Mortar for masonry—Specification	2.6.8
RS EAS 417-2	Concrete — Part 2: Specification of constituent materials, production of concrete and compliance of concrete.	2.6.8
ISO 12439	Mixing water for concrete	2.6.8
RS EAS 148-1	Cements — Test methods— Part 1:Determination of strength	2.6.8
RS EAS 148-2	Cements — Test methods— Part 2: Chemical analysis	2.6.8
RS EAS 148-3	Cements — Test methods— Part3: Determination of setting time and soundness	2.6.8

RS EAS 148-4	Cement — Test methods— Part 4 : Quantitative determination of constituents	2.6.8
RS EAS 148-5	Cement — Test methods— Part 5:Pozzolanicity test for pozzolanic cements	2.6.8
RS EAS 148-6	Cement— Test methods— Part 6: Determination of fineness	2.6.8
RS EAS 131-1	Concrete −Part 1: Specification, performance, production and conformity	2.6.8
RS EAS 148-7	Cement — Test methods— Part 7: Methods of taking and preparing	2.6.8
RS EAS 148-8	Cement — Test methods— Part 8:Determination of chlorine, carbon dioxide and alkali content of the cement	2.6.8
RS EAS 18-1	Cements —Part 1: Composition, specification and conformity criteria for common cements	2.6.8
RS EAS 180	Specification for aggregates from natural sources for use in concrete	2.6.8
RS ISO 15630-1	Steel for the reinforcement and pre-stressing of concrete — Test methods —Part 1:Reinforcing bars, wire rod and wire	2.6.8
RS ISO 15630-2	Steel for the reinforcement and pre-stressing of concrete — Test methods —Part2:Welded fabric	2.6.8
RS ISO 15630-3	Steel for the reinforcement and pre-stressing of concrete — Test methods —Part 3:Prestressing steel	2.6.8
RS 107	Specifications for Building sands	2.6.8
RS 96-1	Methods of test for aggregates— Part 1:General requirements for apparatus and calibration	2.6.8
RS 96-11	Methods of test for aggregates— Part 11:Method of testing and classifying the drying shrinkage of aggregate for use in concrete	2.6.8
RS 96-4	Methods of test for aggregates— Part 4:Mehods for determination of particle size distribution, sieve test	2.6.8
RS 96-5	Methods of test for aggregates— Part 5: Methods for the determination of particle shape — Flakiness index	2.6.8
RS 96-6	Methods of test for aggregates— Part 6:Methods of determination of shell content in coarse aggregates	2.6.8

RS ISO 1920-4	Methods of testing concrete — Part 4:Strength of hardened concrete	2.6.8
RS ISO 1920-5	Methods of testing concrete — Part 5:Properties of hardened concrete other than strength	2.6.8
RS 96-8	Methods of test for aggregates— Part 8:Methods for determination of ten percent fines value	2.6.8
RS 96-9	Methods of test for aggregates— Part 9: Methods for determination of aggregates impact value	2.6.8
RS 142	Design for concrete structures- code of practice	2.6.8
ASTM C935-13	Standard specification for general requirements for pre-stressed concrete poles statically cast	2.6.8
RS ISO 6935-1	Steel for reinforcement of concrete Part 1:Plain bars	2.6.8
RS ISO 6935-2	Steel for reinforcement of concrete Part 2; ribbed bars	2.6.8
RS ISO 6935-3	Steel for reinforcement of concrete Part 3:welded fabrics	2.6.8
RS ISO 1920-5	Methods of testing concrete — Part 5:Properties of hardened concrete other than strength	2.6.8
RS ISO 1920-4	Methods of testing concrete — Part 4:Strength of hardened concrete	2.6.8
RS 142	Design for concrete structures- code of practice	2.6.8
ISO 2848	Building construction— Modular coordination— Principles and rules	2.6.9
RS 142	Design for concrete structures— Code of practice	2.6.9
RS EAS 417-2	Concrete — Part 2: Specification of constituent materials, production of concrete and compliance of concrete	2.6.9
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RWANDA BUILDING CODE

Chapter One:
GENERAL PROVISIONS

PART 3:

ADMINISTRATION & ENFORCEMENT

CONTENTS

PART 3 : ADMINISTRATION & ENFORCEMENT

SECTION 1 : ADMINISTRATION & ENFORCEMENT

1.3.1.1. **organ having jurisdiction:** Unless otherwise provided for by the law, the Building Control Authority shall have overall jurisdiction and shall administer all matters covered by this Code.

1.3.1.2. **DELEGATION OF POWERS FROM BUILDING CONTROL AUTHORITY TO BUILDING CONSENT AUTHORITIES**

The Building Control Authority shall have jurisdiction to efficiently administer the provisions of this Code and amendments thereto. Through delegation of power, planning and building control shall be administered activities the "Building Consent Authority" where the project is to take place.

The building consent authorities shall perform the following duties:

(i) Enforce the provisions of this Code, policies and procedures necessary for the application of this code.

(ii) Request submission of the building permit application file including plans, technical specifications, drawings and description of the project for which a permit is being applied for, examine and check the content of the application file in accordance with relevant regulations, and upon approval, issue a permit Inspect all works authorized by any permit under the provisions of this Code or amendments made thereto and by approving or condemning any work in whole or in part as conditions may require; Inspect all works authorized by any building permit under the provisions of this Code or amendments made thereto, inspect any other construction works and administer sanctions in case of any faults, as provided by in this Code;

(iii) Keep a complete record of all building permitting, inspection and project processing documents for future consultation.

1.3.1.3. BUILDING OFFICIAL

1.3.1.3.1. Except as otherwise provided for by this Code herein, a Building Official is a person responsible for implementation of the provisions of this Code through enforcement of building regulations, orders and decisions made pursuant thereto, and on field verification of the implementation of the approved plans;

1.3.1.3.2. Building Officials within the Building Consent Authority and Building Control Authority shall be recruited in accordance with modalities for the recruitment, appointment and nomination of public servants and/or any other laws in force.

1.3.1.4. QUALIFICATIONS OF BUILDING OFFICIALS

1.3.1.4.1. No person shall be appointed as a Building Official unless he/she possesses the following qualifications:

(i) A duly registered Building Professional;
(ii) A member of a duly accredited organization of his profession for not less than two years; and
(iii) Has the required academic and professional qualifications and experience in building design and/or construction.

1.3.1.5. DUTIES OF A BUILDING OFFICIAL

1.3.1.5.1. In his/her respective area of operation, the Building Official or Officials shall be responsible for the enforcement of the provisions of this Code as well as the implementing rules and regulations that may be issued there under.

1.3.1.6. LIMITED LIABILITY OF BUILDING OFFICIALS

1.3.1.6.1. The Building Officials acting in good faith and without malice in the discharge of the duties required by the Code or other pertinent law or ordinance shall not be rendered personally liable for damages that may accrue to persons or property as a result of an act or omission in the discharge of such duties, act or omission in the implementation of the designs, specifications and approved plans or drawings. A suit brought against the authorized personnel or Building Official because of such

act or omission performed by the authorized personnel in the enforcement of any provision of this Code or other pertinent laws or ordinances implemented through the enforcement of this Code shall be defended by the Building Control Authority or building consent authority whatever the case maybe until final termination of such proceedings.

1.3.1.6.2. The building officials acting in bad faith and malice in the discharge of the duties required by the Code or other pertinent law or ordinance shall be rendered personally reliable for the damage that may accrue to persons or property as a result of such an act or omission in the discharge of such duties.

SECTION 2: PROFESSIONAL ENGAGEMENT & RESPONSIBILITIES

1.3.2.1. **Building Officials:** In accordance with the prescribed procedures governing modalities for the recruitment, appointment and nomination of public servants, the City of Kigali or Districts Authority shall have the authority to appoint qualified and experienced technical officers, inspectors, and reviewers of plans from different disciplines such as engineers, architects, town planners, land surveyors, Quantity Surveyors, environmental experts, landscape architects, real estate managers, urban designers and other personnel as may be necessary to carry out the functions provided for in of this code and as may be deemed necessary decided. Such personnel should have proven diversified and professional experience in building design and construction as well as in the other related field as mentioned in the previous section of this Code. herein before.

1.3.2.2. **Requirements for Registration of Professionals into Professional Regulatory Bodies:** The requirements of this Code with regard to professionals shall be deemed satisfactory only, when the professional satisfies complies with the requirements of the respective registration and/or accreditation statutes governing their respective regulatory bodies.

1.3.2.3. **Registry of Professionals:** For the purpose of this Code, a Building control authority shall keep a registry of qualified architects and structural/civil designers and other professionals as provided by their respective bodies and engineers, town planners, land surveyors, quantity surveyors, environmental experts, real estate managers and other professionals as may be deemed necessary.

1.3.2.4. **Certification of Works:** On completion of the building operations with respect to the buildings of categories 3, 4 & 5 the architect or the engineer, as the case may be, shall provide the Building Consent Authority with a certificate (see section 17 form 6 and form 7) confirming that the work has been carried out in accordance with the design and the specifications and complies with the relevant approved standards and relevant sections of this Code.

1.3.2.5. **Change of Professionals:** In case the registered professional associated with the preparation and signing of plans or for supervision is being changed during any stage of building/land development process, the owner that professional shall notify the Building Consent Authority in writing about further non-association with the project.

1.3.2.6. **Notification of Termination and Succession of a Building Professional:** If the owner of a building terminates the agreement with his or her appointed architect, engineer or any other professional at any time before the occupation permit is issued, the owner shall immediately notify the Building Consent Authority in writing. The owner shall also notify the Building Consent Authority of the new professional who will continue the assignments.

1.3.2.7. **Professional Liability:** The engineer, architect or any other professional who undertakes design or supervision works associated with building or non-building structure shall be liable for such design works for a period of 10 years from the date of final acceptance of the structure. The contractor is equally liable for the same period of ten years for works executed, from the date of their final acceptance.

Note: Developers, General Contractors, subcontractors, suppliers, architects, engineers and other design professionals may all be held liable for building deficiencies and failure to meet any of the requirements of this Code in contract and/or offence, and in some circumstances, for a breach of fiduciary duty.

1.3.2.8. **Professional Indemnity**: Different professionals involved in implementation of the provisions of this Code shall be required to hold professional indemnity insurance from their respective professional bodies or any Insurance Company.

1.3.2.9. **Latent defect Liability:** Any parties involved in the construction process are legally required to obtain a latent defect liability—or decennial (10 years) liability—insurance policy to cover possible structural flaws or problems in the building once it is in use.

1.3.2.10. Contractor's Insurance: Contractor shall be required to have workers' compensation, general liability and property damage insurance for any accident and for any part of building and any other risks that may be associated with the works, including man-made and natural disasters, except those that may occur due to force majeure.

SECTION 3: BUILDING PERMITS

1.3.3.1. PERMITS REQUIRED

1.3.3.1.1. No person, firm or corporation shall develop/erect, construct, enlarge, alter, repair, move, convert or demolish any building or structure or cause the same to be done, without first obtaining a separate building permit for each of such development/building from the Building Consent Authority.

1.3.3.1.2. For any building illegally erected without a building permit, the owner shall not be compensated in case of expropriation for public interest.

1.3.3.2. TYPES OF PERMITS

Subject to the provisions of Article 85 of the Law No. 10/2012 of 02/05/2012 Governing Urban Planning and Building in Rwanda, a permit shall be required for:

(i) Development /New construction;
(ii) Refurbishment of existing building with structural alteration;
(iii) Rehabilitation and refurbishment without structural alteration;
(iv) Occupancy (Provisional or Definitive);
(v) Change of use/occupancy;
(vi) Construction of Non-building Structure; and
(vii) Demolition.

1.3.3.3. FURTHER REQUIREMENTS

Permits may be further required for, but not limited to, the following:

(i) All Television/Radio Communication Towers, etc., as regulated by the Public Utility Regulatory Agency;
(ii) Complete new installations of all solar water heating systems or the complete replacement of existing system with all new components or the relocating of panels from the roof to the ground or vice versa, along with plumbing and electrical systems;

(iii) Construction or renovation of disabled accessible routes from parking lot to building or from building to building on a lot;

(iv) Water tanks or catchments intended for potable/household use, regardless of height or size. For additional requirements where water tank or catchment systems are used as means of fire protection; and

(v) Retaining walls 2 m and higher. (Stepped or terraced retaining walls 2 m of each other are considered to be one wall when determining wall height).

1.3.3.4. EXCEPTIONS

Subject to the provisions of Article 83 of the Law No. 10/2012 of 02/05/2012 Governing Urban Planning and Building in Rwanda, a permit shall not be required for:

(i) Temporary structures used during the construction of permitted structures.

(ii) Temporary buildings or temporary tents or other coverings used for private family parties or for camping on approved campgrounds, platforms

(iii) Site hoarding fences used during a permitted construction without shifting plot boundary beacons;

Military and police installations meant for National Defence. However, the works shall be undertaken under supervision of a qualified architect or engineer;

Temporary shelter for refugees and internally displaced people;

(iv) The Building Consent Authority shall before granting authorization, assess the intended temporary structure such building in relation to:

a. The intended use and lifespan of the building;
b. The area in which it is to be erected; and
c. The suitability of materials that shall be used Any building intended to be used for experimental, demonstration, testing or assessment purposes shall be regarded as a temporary building:

a. When testing or assessment of the completed building is the only way to demonstrate compliance with the requirements or the regulations;

b. for a period of time as applied for the erection of the building and for the performance of any experiment or the demonstration, testing or assessment of such building;

1.3.3.5. CONSIDERATION OF OTHER LAWS

While assessing the content of the building permit application file, the Building Consent Authority shall take into account the provisions from other applicable laws and regulations for layout, building plans, water supply, sewerage, drainage, electrification, etc The Building Consent Authority shall also take care of the need for landscape development plan incorporating rainwater harvesting proposals in the layout and building plans.

1.3.3.6. OTHER STAKEHOLDERS IN ISSUANCE OF PERMITS

In addition to the Building Consent Authority, specific approvals shall be obtained from the consolidated focal persons of the relevant stakeholders/institutions such as the Government institution in charge of Civil Aviation, Government institution in charge of regulation of Utilities, Government institution in charge of Energy, Rwanda National Police Fire Services Department, Government institution in charge of Environmental Management, and any such other Building Consent Authority as may be applicable.

1.3.3.7. SPECIAL BUILDING PERMIT APPLICATION REVIEW TEAM

In order to facilitate clearance from the above bodies with the concept of a single clearance centre and thereby final approval by the Building Consent Authority within the stipulated time frame, the Building Consent Authority may constitute a special building permit application review team consisting of representative of the team of building officials or representatives of bodies/organizations from whom clearance for development/building permit clearance is required. Recommendations from such team shall be summarily utilized by the Building Consent Authority in the sanctioning process.

1.3.3.8. PROFESSIONAL INVOLVEMENT IN PERMIT APPLICATION

When it is required that documents be prepared by a registered design professional, the Building Consent Authority shall require the registered design professionals to review and approve the building proposals including plans and certify completion of building for issue of related regulatory building permits and occupancy certificate for residential, industrial and commercial buildings designed by self or otherwise.

1.3.3.9. CATEGORIES OF BUILDINGS

For the purpose of determining conditions for professional involvement in permit application, the following categories shall apply:

Table 1.3.3-1: Categories of Buildings

S/N	Category of Buildings	Description
01	**Category 1**	Category one comprises structures which can be removed without compensation and it is characterizes by the following conditions: i) It does not require construction permit; ii) It has a total floor area that does not exceed 1000sqm; iii) It must be non-storeyed and basement free structure; iv) It Accommodates not more than 500 people; v) Its validity cannot be longer than 2 years. vi) It must not be intended for worship, industries, storage of hazardous and perishable commodities and goods.
02	**Category 2**	Category 2 comprises administrative, residential and commercial buildings except industrial buildings, hazardous buildings, health facilities that are characterized by the following: i) Total floor area not exceeding 200 m^2; ii) Non storeyed and basement-free (G+0); iii) Capacity to host 15 people or less.
03	**Category 3**	Category 3 comprises Residential, Commercial buildings including warehouses, except Industrial buildings, hazardous buildings, health

		facilities, and which are simultaneously characterized by: i) total floor area not exceeding 1500 m2 and plot size not exceeding 1000m2; ii) not higher than two storied building (G+1); iii) Capacity to host 50 people or less; iv) The total height of the building not exceeding 7m.
04	**Category 4**	Category 4 comprises towers and antennas, all types of buildings, except industrial buildings and hazardous buildings which are characterized by the following aspects: i) buildings with three (3) storeys and above (≥G+2) with or without basements, ii) buildings with the capacity to host people not exceeding five hundred (≤500);
05	**Category 5**	Category 5 comprises: i) sports facilities, social, cultural, and assembly and religious buildings, health facilities, educational buildings, or other publicly accessible facilities with a capacity to host more than 500 people; ii) industrial buildings and hazardous buildings; iii) Memorial Sites; iv) All other structures not specified in any other category.
06	**Category 6**	Category 6 does not require building permit and it comprises all: i) specific buildings for national security excluding social, residential and commercial buildings; ii) Temporary shelter for returnees, refugees and internally displaced people.

1.3.3.9.1. REQUIRED CONDITIONS FOR PROFESSIONAL INVOLVEMENT IN PERMIT APPLICATION

(i) A demand for building permit for Buildings of Category 1 and 2 does not require certification by an architect or a civil engineer;

(ii) An application for building permit for Categories 3 shall be certified by an architect or civil engineer;

(iii) An application for building permit for Buildings Categories 4 and 5 shall be certified by an architect and civil engineer; and

(iv) Building in category 1 and 6 shall not request a permit but construction works for Building in category 6 shall be undertaken under the supervision of qualified architect and engineer.

1.3.3.10. DEMOLITION PERMIT

1.3.3.10.1. Any owner or authorized agent who intends to remove a building or part thereof shall request for a demolition permit. This provision includes buildings that shall be demolished during an upgrading and /or construction on sites approved for construction where removal of parts or all existing structures is required.

1.3.3.10.2. Demolition works shall also be carried out whenever there are grounds justifying that the use of a building is unsafe. The Building Consent Authority shall notify the owner, in writing, the reasons for any required demolition.

1.3.3.10.3. The demolition of a building likely to affect or disrupt the normal conduct of public activities or constitute a danger to the public shall be carried out by experts.

1.3.3.11. MISUSE OF ISSUED PERMITS

1.3.3.11.1. An issued permit shall not be interpreted as an approval for violation of any provision of this Code or any other Law or bylaw. Permits implying to give power to violate or cancel the provisions of this Code or other law shall not be valid.

1.3.3.11.2. The Building Consent Authority has the discretion to request correction of errors noticed in approved plans and any construction documents, after issuance of permit. The issuance of a permit based on construction documents and other data shall not prevent the Building Consent Authority from requiring the correction of errors in the construction documents and other data.

SECTION 4: CONTROL & APPEALS

1.3.4.1. BUILDING CONTROL

1.3.4.1.1. Building Consent authority oversights shall be handled by a committee in charge of building control, referred to as the "Urban Planning Coordination Meeting", as provided for in the Urban Planning Code. The committee is established as this Code comes into force and the building control authority shall determine its members, powers and functions.

1.3.4.2. APPEALS

1.3.4.2.1. The Urban Planning Coordination Meeting and a representative from Building Control Authority shall function as the Appeals Committee.

1.3.4.2.2. OUTCOME OF APPEALS

The findings and decisions of members of the appeals committee shall be deemed conclusive. And in case the plaintiff is not satisfied with the decision of the appeals committee she/he may appeal to a court of law.

SECTION 5: TEMPORARY STRUCTURES & USES

1.3.5.1. For any application to erect a building that qualifies to be a temporary building, the Building Consent Authority may grant authorization for the applicant to proceed with the erection of the building, subject to compliance with any conditions or directions specified in the authorization upon submission of a notice. Such authorization shall be limited as to time of service; the demolition of these buildings shall be as specified during the application for the authorization, but not exceeding two years.

1.3.5.2. The building official is authorized to grant extensions for demonstrated cause at the request of the owner

1.3.5.3. The Building Consent Authority shall, before granting the authorization, require the owner of the temporary building to submit a site plan with the application accompanied by layout drawings in sufficient detail, to enable the Building Official to determine the general size, form, materials of construction and use of the proposed temporary building

1.3.5.4. Temporary structures and uses shall conform to the structural strength, fire safety, and means of egress, accessibility, light, ventilation and sanitary requirements of this Code as necessary to ensure public health, safety and general welfare in accordance with good practice.

1.3.5.5. Such buildings and temporary structures shall be completely removed on the expiry of the period specified in the authorisation or before expiry period if deemed necessary by the Building Consent Authority without any compensation.

SECTION 6: FEES

1.3.6.1. FEES RECORDS

Every Building Consent Authority shall keep a permanent record and accurate account of all fees and other charges imposed as authorized by the Presidential Order establishing the list of fees and other charges levied by decentralized entities and determining their thresholds to be collected and received under this Code. The fee shall be deposited in the bank account of the Building Consent Authority within which the proposed building is to be constructed.

RWANDA BUILDING CODE

Chapter One:
GENERAL PROVISIONS

PART 4:

CLASSIFICATION OF BUILDINGS & STRUCTURES

SECTION 1: GENERAL PRINCIPLES
SECTION 2: USE & OCCUPANCY
SECTION 3: CLASSIFICATION BY TYPE OF CONSTRUCTION
SECTION 4: MULTIPLE CLASSIFICATION
SECTION 5: HEIGHT & AREA LIMITATION
SECTION 6: DESIGN POPULATION

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PART 4: CLASSIFICATION OF BUILDINGS & STRUCTURES

SECTION 1: GENERAL PRINCIPLES

1.4.1.1. The classification of a building or part of a building shall be determined by the purpose for which it is designed, constructed or adapted to be used /occupied.

1.4.1.2. Buildings or portions of buildings shall be classified with respect to occupancy in one or more of the groups listed in table 1.4.1-1. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Where a building is proposed for a purpose that is not specifically provided for in this Code, such building shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1.4.1.3. The Rwanda Building Code has eleven main occupancy groups as well as multiple subgroups. The occupancy group or subgroup defines the specific use of the building. Subgroups are numbered based on the perceived risk for the building occupants. The lower the subgroup number, the higher the perceived risk. Occupancy groups and subgroups are defined as follows:

Table 1.4.1-1: Occupancy Classification

S/No.	GROUP	CLASSIFICATION	SUB- GROUPS	
01	A	ASSEMBLY	A-1, A-2, A-3, A-4, A-5	Gatherings/civic/religious/social/recreational
02	B	BUSINESS (COMMERCIAL)	B-1. B-2 and B-3	Office/Professional or Service Transactions
03	E	EDUCATIONAL	E-1 and E-2	Schools
04	F	FACTORY AND INDUSTRIAL	F-1 and F-2	Manufacturing/Fabrication/Packaging

05	I	INSTITUTIONAL	I-1, I-2, I-3 and I-4	Assisted Living/Hospitals/Prisons
06	M	MERCANTILE	M-1, M-2, and M-3	Display & Sale of Merchandise
07	R	RESIDENTIAL	R-1, R-2, R-3, R-4, R-5	Housing/Apartments/Hotel
08	S	STORAGE	S-1 and S-2	Non or Low-Hazardous Storage (parking garages)
09	MEM	MEMORIAL		
10	MIX	MIXED USE		
11	MISC	MISCELLANEOUS		Other Structures

Table 1.4.1-2: Use and Occupancy Classification

Class	Sub- Group	Description
A - ASSEMBLY		These shall include any building or part of a building, where number of persons not less than 50 congregate or gather for amusement, recreation, social, religious, patriotic, civil, travel and similar purposes. Examples include theatres, motion picture houses, assembly halls, auditoria, exhibition halls, museums, gymnasiums, restaurants, places of worship, dance halls, club rooms, passenger stations and airports, surface and marine public transportation services, recreation piers and stadia, etc.
	A-1 - Entertainment and public assembly	Occupancy where persons gather to eat, drink, dance or participation other recreation.
	A-2 - Theatrical and indoor sport	Occupancy where persons gather for the viewing of theatrical, operatic, orchestral, choral, cinematographically or sport performance
	A-3 - Places of instruction	Occupancy where school children, students or other persons assemble for the purpose of tuition or learning for less than 8 hours per week
	A-4 - Worship;	Occupancy where persons assemble for the purpose of worshipping
	A-5 - Outdoor sport;	Occupancy where persons view outdoor sports events

B –BUSINESS **(COMMERCE/SERVICES)**		Occupancy where transaction of business of non-industrial process is carried out. Example of use of the building or structure, or a portion may include;- office, professional or service-type transactions, , airport traffic control towers, Banks;; Clinic—outpatient; Electronic data processing; Laboratories—testing and research; Motor vehicle showrooms; Post offices; Print shops; keeping of accounts and records and similar purposes, Professional establishment and services (architects, attorneys, dentists, physicians, engineers, etc.); Radio and television stations; Telephone exchanges; Training and skill development not within a school or academic program.
	B 1- High risk commercial service	Occupancy where a non-industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions.
	B 2- Moderate risk commercial service	Occupancy where a non-industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with moderate rapidity but is not likely to give rise to poisonous fumes, or cause explosions.
	B 3- Low risk commercial service.	Occupancy where a non-industrial process is carried out and where neither the material handled nor the process carried out falls into the high or moderate risk category

E- EDUCATIONAL		Occupancy where school children, students or other persons assemble for the purpose of tutoring or learning. These shall include any building used for school, college, and other training institutions for day-care purposes
	E 1 – Up to Senior Secondary level.	This sub-division shall include any building or a group of buildings under single management, which is used for students not less than 20 in number
	E 2 - All others/training Institutions	This sub-division shall include any building or a group of buildings under single management that is used for students not less than 100 in number.
F-FACTORY AND INDUSTRIAL		Places where goods are manufactured or repaired (unless considered "High-Hazard"
	F- 1 - High risk industrial .	Occupancy where an industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions
	F -2 - Moderate risk industrial	Occupancy where an industrial process is carried out and where either the material handled or the process carried out is liable, in the event of fire, to cause combustion with moderate rapidity but is not likely to give rise to poisonous fumes, or cause explosions.

	F- 3 - Low risk industrial	Occupancy where an industrial process is carried out and where neither the material handled nor the process carried out falls into the high or moderate risk category This shall include any building in which the contents are of such comparative low combustibility and there are hardly any possibilities for any self-propagating fire to occur and the only consequent danger to life and property may arise from panic, fumes or smoke, or fire from some external source.
	F- 4 - Plant room	Occupancy comprising usually unattended mechanical or electrical services necessary for the running of a building.
I - INSTITUTIONAL		Places where people are physically unable to leave without assistance. Examples: hospitals, nursing homes, and prisons.
	I- 1-Place of detention [Restrained]	Occupancy where people are detained for punitive or corrective reasons or because of their mental condition
	I -2- Hospitals and health centres [Incapacitated]	Occupancy where people are cared for or treated because of physical or mental disabilities and where they are generally bed ridden
	I-3- Other Institutional	Occupancy where groups of people who either are not fully fit, or who are restricted in their movements or their ability to make decisions, reside and are cared for

M- MERCANTILE		These shall include any building or part of a building, which is used as shops, stores, market, for display and sale of merchandise, either wholesale or retail. Mercantile buildings shall be further sub-classed as follows:
	M-1-Large shops	Occupancy where merchandise is displayed and offered for sale to the public and where the floor area exceeds 250m^2
	M-2-Small shops	Occupancy where merchandise is displayed and offered for sale to the public and where the floor area does not exceed 250m^2
	M-3-Wholesalers stores	Occupancy where goods are displayed and stored and where only a limited selected group of persons is present at any one time
R- RESIDENTIAL		These shall include any building in which sleeping accommodation is provided for normal residential purposes with or without cooking or dining or both facilities, except any building classified under I (Institutions); Examples: houses, apartment buildings, hotels, and motels. Residential- shall be further sub-classed as follows:
	R-1-Hotel	Occupancy where persons rent furnished rooms, not being dwelling units

	R-2-Lodging	These shall include any building or group of buildings under the same
		management, in which separate sleeping accommodation is provided on transient or permanent basis, with or without dining facilities but without cooking facilities for individuals is provided. This includes inns, clubs, motels and guest houses.
	R-3-Dormitory	These shall include any building in which group sleeping accommodation is provided, with or without dining facilities for persons who are not members of the same family, in one room or a series of closely associated rooms under joint occupancy and single management, for example, school and college dormitories, students, and other hostels and military barracks.
	R-4-Domestic residence/apartments	Occupancy consisting of two or more dwelling units on a single site
	R-5-Dwelling house	Occupancy consisting of a dwelling unit on its own site. May include a garage and other domestic outbuildings, if any. It will usually be occupied by members of one or two families and has a total sleeping accommodation for not more than 20 persons.
S- STORAGE		These shall include any building or part of a building used primarily for the storage or sheltering including servicing, processing or repairs incidental to storage) of goods, ware or merchandise e.g. warehouses, cold storage, freight

		depots, transit sheds, storehouses, hangers and stables.
	S-1- High risk storage	Occupancy where material is stored and where the stored material is liable, in the event of a fire, to cause combustion with extreme rapidity or give rise to poisonous fumes, or cause explosions
	S-2- Moderate risk storage	Occupancy where material is stored and where the stored material is liable, in the event of a fire, to cause combustion with extreme rapidity but is not likely to give rise to poisonous fumes, or cause explosions
	S-3- Low risk storage	Occupancy where the stored material does not fall into the high or moderate risk category
	S-4- Parking garage	Occupancy used for storing or parking of more than 10 motor vehicles
MEM- MEMORIAL		Sites or building erected for commemoration and honor of genocide victims
MIX – MIXED USE		Many buildings may have multiple occupancies. These are referred to as "mixed occupancies" and the different parts will be required to meet the codes for those specific areas. An example of this is a shopping mall with apartments on the upper floors. The shopping area itself is Group M (mercantile), while the apartments would qualify as Class R (Residential).

MISC- MISCELLANEOUS UTILITY	**MIX-1- Accessory occupancy**	buildings often have rooms or spaces different from but accessory or ancillary to the main occupancy. That space or room shall be considered ancillary when it does not exceed 10% of the area of the story in which it is located. The accessory occupancy does not need to be accounted for in construction type determination and related height/area determination for a building. The allowable building area and allowable building height of the ancillaries are permitted to be based solely on the main occupancy classification(s).
	MIX-2- Non- separated occupancy	multiple occupancies without a physical separation between them. Occupancies are individually classified in accordance with this code the requirements of the code are based on the occupancy classification of the space, except that the most restrictive requirements for fire safety are applied to the total non-separated occupancy fire area.
	MIX-3- Separated occupancies	require physical separation by fire barrier walls and/or horizontal assemblies with a fire-resistance rating between occupancies. Occupancies are located in separate fire areas, and each fire area is required to comply with the code based on the occupancy classification of that portion of the building.
		Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy. They shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy. Examples: Agricultural

		buildings; Aircraft hangars, accessory to a one- or two-family residence; Barns; Carports; Fences more than 6 feet (1829 mm) 2m high; Grain silos, accessory to a residential occupancy; Greenhouses; Livestock shelters; Private garages; Retaining walls; Sheds; Stables; Tanks; Swimming pools …

SECTION 2: CLASSIFICATION BY FIRE RESISTANCE

1.4.3.1 **General:** Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in sub-sections 1.4.3.3 through 1.4.3.6. The building elements shall have a fire-resistance rating not less than that specified in Section 3.8.2 of this Code and exterior walls shall have a fire-resistance rating not less than that specified in Section 3.8.2 of this Code as per the classifications below:

(i) Type I (fire resistive) Least combustible
(ii) Type II (non-combustible)
(iii) Type III (ordinary)
(iv) Type IV (heavy timber)
(v) Type V (wood frame) Most combustible

1.4.3.2 **Minimum requirements:** A building or portion of it shall not be required to conform to the details of a type of construction higher than that type, which meets the minimum requirements based on occupancy even though certain features of such a building actually conform to a higher type of construction.

1.4.3.3 Types I and II: Type I and II constructions are those types of construction in which the building elements are of non-combustible materials, except as permitted elsewhere in this Code.

TYPE I is supposed to confine fire by its construction. In this type of construction, the building elements are of non-combustible materials such as concrete and steel. The roof is also of non-combustible material such as concrete or steel

TYPE II. This type of building has steel or concrete walls, floors and structural framework similar to type I construction. However, the roof covering material is combustible. The roof covering of a type II building can be a layer of asphalt water proofing, with a combustible felt paper covering. Another layer of asphalt may be mopped over the felt paper.

1.4.3.4 Type III: Type III construction is that type of construction in which the exterior walls are of non-combustible materials and the interior building elements are of any material permitted by this Code. This type of constructed building is also called a brick and joist structure by some. It has masonry bearing walls but the floors, structural framework and roof are made of wood or other combustible material. For example: concrete block building with wood roof and floor trusses. Fire-retardant-treated wood framing shall be permitted within exterior wall assemblies of a 2-hour rating or less.

1.4.3.5 Type IV: Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of non-combustible materials and the interior building elements are of solid or laminated wood without concealed spaces. The details of Type IV construction shall comply with the provisions of this section. Fire-retardant-treated wood framing shall be permitted within exterior wall assemblies with a 2-hour rating or less.

1.4.3.6 Type V: Type V - Wood-frame construction is the most combustible of the five building types. The interior framing and exterior walls may be wood. A wood-frame building is the only one of the five types of construction that has combustible exterior walls. These buildings may be built with 2 x 4 or 2 x 6 studs and load bearing walls, wood floor trusses or wood floor joist and wood roof framing.

Protected "A" means that all structural members of a building or structure has additional fire rated coating or cover by means of drywall, spray on, or other approved method. This additional fire rated coating or cover extends the fire resistance rating of structural members for at least 1 hour.

Un-protected "B" means that all structural members of a building or structure have no additional fire rated coating or cover.

1.4.3.7. Allowable combustible material in type I and II construction: Combustible materials shall be permitted in buildings of Type I or Type II construction in the following applications

(i) Fire-retardant-treated wood shall be permitted in:

a. Non-bearing partitions where the required fire-resistance rating is 2 hours or less.

b. Non-bearing exterior walls where no fire rating is required.

(ii) Roof construction, including girders, trusses, framing and decking.

Exception:

(i) In buildings of Type I construction exceeding two stories in height, fire-retardant-treated wood is not permitted in roof construction when the vertical distance from the upper floor to the roof is less than 6m.

(ii) Thermal and acoustical insulation other than foam plastics, having a flame spread index of not more than 25 or other materials as will be specifically stated in later chapters.

(iii) Piping. The use of combustible piping materials shall be permitted when installed in accordance with the limitations of this code.

(iv) Electrical. The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted when installed in accordance with the limitations of this Code.

SECTION 3: MULTIPLE CLASSIFICATION, HEIGHT & AREA LIMITATION

1.4.4.1. While many buildings may have multiple occupancies, each part of a building must be classified separately and where there are "mixed occupancies" the different parts will be required to meet the Codes for those specific areas. An example of this is a shopping mall with underground parking. The shopping area itself is Group M (mercantile), while the parking area would qualify as Group S (storage). In this case where parts have different purposes - if not more than 10% of the floor area of a storey, being the minor use, is used for a purpose which is a different classification, the classification applying to the major use may apply to the whole storey. A plant room, machinery room, lift motor room, boiler room or the like must have the same classification as the part of the building in which it is situated.

1.4.4.2. In places where the building can be classified in more than one occupancy the stricter Code provision is usually enforced. An example of this is a restaurant with seating under 50 which is not addressed in the Code as either mercantile or business (this is a technical issue, but could be viewed as either or neither). Code enforcement officials will usually enforce the strictest side of the Code.

1.4.5.1. The maximum height and number of storeys of every building shall depend on the character of occupancy and the type of construction, considering population density, building coverage, widths of streets and car parking requirements and shall be in accordance with the provision of the Urban Planning Code.

SECTION 4: DESIGN POPULATION

1.4.6.1 The population of any room or storey or portion thereof shall be taken as the actual population of such room, storey or portion thereof where such population is known, where such population is not known, the population shall be calculated from the criteria given in Table 1.4.6-1.

Table 1.4.6-1: Design Population

Class of Occupancy	Design Population
A-1, A-2, A-4, A-5, A-6	Number of fixed seats or 1 person per m^2 where there are no fixed seats
I-2, I-3, R-1, R-2, R-4, R-5 R-7	2 persons per bedroom or actual number of persons, whichever is the greater.
F-1, F-2, F3, M-1, M-2	1 person per 10 m^2 or actual number of persons, whichever is greater
F4, M-3, S-1, S-2, S-3, S-4	1 person per 30 m^2
B-1, B-2, B-3, R6, MISC	1 person per 10m^2
I-1, R-3	1 person per 5 m^2
A-3, B-4, B-5, E-1, E-2	1 person per 4 m^2

1.4.6.2 Any building not covered above shall be classified in the group which most nearly resembles its existing or proposed use.

1.4.6.3. Where change in the occupancy of any building places is in a different group or in a different subdivision of the same group, such building shall be made to comply with the requirements of the Code for the new class or its sub-division.

RWANDA BUILDING CODE

Chapter One:
GENERAL PROVISIONS

PART 5:

DEVELOPMENT PLANNING & GENERAL BUILDING REQUIREMENTS

CONTENTS

PART 5: DEVELOPMENT PLANNING & GENERAL BUILDING REQUIREMENTS

SECTION 1: REQUIREMENTS FOR BUILDING PERMIT APPLICATION

1.5.1.1. **Development Permission:** No person shall develop or cause to be developed any non-temporary building on land where development permission has not been granted, except for specific buildings as outlined in this code.

1.5.1.2. **Conditions for issuance of building permit:**

Granting building permits shall comply with:

(i) Any existing and applicable urban planning document;
(ii) Planning and building regulations in force (this Code);
(iii) Any provisions established by law, including regulation on road, rail and waterways network, road traffic, transmission of energy, aeronautics, protection of water resources, sanitation and environment protection; and
(iv) Any existing public infrastructures and utilities plans.

1.5.1.3. **Conditions for the issuance of building permit in area without existing urban planning documents:**

When the area for development has no urban plan in place, in addition to compliance with articles 1.5.1.1, and 1.5.1.2 on the issuing of building permits, the Building Consent Authority shall consider that:

(i) The proposed development is not located in an area for which the Planning Authority has decided to elaborate, update or revise a planning document;
(ii) A plot where development is proposed shall be directly accessible;
(iii) The proposed use of the development is compatible with neighbouring uses;

SECTION 2: PRESENTATION OF PLANS

1.5.2.1. **Procedure for application for building permit:** An application for building permit shall be submitted to the Building Consent Authority as applicable.

(i) There shall be a consultation between the applicant or his/her representative and an authorized staff of the Building Consent Authority as applicable for verification and approval of the completeness of the building permit application file;

(ii) When using online application through the certified online permitting management information system, the complete set of documents shall be uploaded by authorized person;

(iii) The technical assessment of the permit demand file starts once the building permit application file completeness has been approved by the Building Consent Authority.

1.5.2.2. **Application and Presentation of Plans:** An application (see section 17, Form 1), signed and dated by the owner, shall be accompanied by at least one set of plans, drawings and diagrams which shall be clear and legible, on suitable durable material, and shall contain the name of the owner of the plot and shall be signed, stamped and dated by the architect where applicable, and every alteration thereafter shall likewise be dated, stamped and signed.

1.5.2.3. **Building plans approval or Refusal:** The Building Consent Authority may either approve or refuse the plans and specifications or may approve them with such modifications or directions as it may deem necessary and thereupon shall communicate its decision to the person giving the notice. In the case of refusal, the Building Consent Authority shall quote the reason and relevant sections of the Code which the plans contravene. The Building Consent Authority shall as far as possible, advice all the objections to the plans and specifications in the first instance itself and shall ensure that no new objections are raised when they are resubmitted after compliance of earlier objections.

Once the plan has been scrutinized and objections have been pointed out, the owner giving notice shall modify the plan to comply with the objections raised

and re-submit it. The Building Consent Authority shall scrutinize the re-submitted plan and if there be further objections, the plan shall be rejected.

1.5.2.4. **Grant of Permit and Duration of assessment period:** The first response/invalid notice/non-compliance intimation shall be issued by the Building Consent Authority to the owner within 7 working days of submission of the plans to the Building Consent Authority. When all the requirements for the permit are fulfilled and comply with articles 1.5.1.4, the duration taken to assess and approve a complete building permit application file and deliver a building permit shall not exceed 30 calendar days from the date of confirmation of completeness of the file. In case the permit cannot be delivered within the prescribed time mentioned above for any reasons, the District or the City of Kigali Council shall inform the applicant in writing.

1.5.2.5. **Expiration:** When a building permit has been granted, works shall commence within two (2) years of issuance and works shall be completed within 1 to 5 years depending on the Category of Building Project as per instructions by the District Council or City of Kigali Council as applicable.

(i) Every permit issued by the Building Official under the provisions of this Code shall expire by limitation and become null and void:
   a. After its period of validity as stipulated on the permit, or
   b. Two years from the date of issuance if the building or work authorized by the permit is not commenced by such date.

Extension of time may be granted and shall be of a reasonable length of time but in no case exceed six months. Requests for an extension must be made in writing to the Building official.

(ii) Upon expiration of a permit, all work shall cease and shall not be recommenced until a new permit is obtained. The building official may waive the requirements for submittal of plans and specifications in connection with a permit renewal if the work previously permitted remains the same and no amendments have been made to the building code affecting the work, and previously approved plans are still on file. When

the building official determines that plans need not be submitted, the original plans, stamped and approved by the building official shall be the renewed permit plans.

1.5.2.6. **Building permits extension:** The request for extending the building permit shall be submitted to the Building Consent Authority where the previous building permit was issued.

1.5.2.7. **Obligation to complete construction:** In case a building permit expires before completion, the execution works shall be suspended. Any renewal of the building permit will be subject to payment as shall be determined by Building Consent Authority.

1.5.2.8. **Revocation of Permit:** The Building Consent Authority may revoke any permit issued under the provisions of the Code, wherever there has been any false statement, misrepresentation of any material fact in the application on which the permit was based or violation of building permit or in case of noncompliance thereof and shall state the reasons for revoking the permit.

1.5.2.9. **Restoration of permit:** The owner shall be required to modify plans to comply with regulations before the permit is restored for that purpose.

SECTION 3: SITE PLANS & PARTICULARS

1.5.3.1. **Plans, drawings and diagrams:** Shall be drawn to suitable scales but not smaller than the scales indicated in the following paragraphs:

(i) Site Plans: 1:2500 or 1:1250 or 1:1000 or 1:500 or 1:250 or 1:200 or 1:100;
(ii) Drainage installation drawings: 1:200 or 1:100 or 1: 50;
(iii) Layout drawings (including demolition drawings, if any) 1:100 or 1:50 or 1:20;
(iv) Sections & Elevations: 1:100 or 1:50;
(v) General structural arrangements and details: 1:100 or 1:50 or 1:20 or 1:10 or 1:5 or 1:2 or 1:1
(vi) Fire protection plans: 1:200 or 1:100 or 1:50 or 1:20.

1.5.3.1. **Letters:** In all cases the scales used shall be stated on the plans, drawings or diagrams and the letters and symbols adopted shall be not less than 2.5 mm.

1.5.3.2. North point: The North point shall be indicated at the top right-hand corner of all the site or location plans.

1.5.3.3. Site Plans information: A site plan referred to in sub-articles 1.5.3.1 of these regulations shall contain the following information where applicable:

(i) Dimensions of the site on which the building is to be erected, the boundaries of such site with its geo-coordinates, the dimensioned position of any building line and the position and width of any servitude or right of way to which such site is subject;
(ii) Registered number or other designation of the site;
(iii) Direction of true north and if required, the natural ground contours at suitable vertical intervals or spot levels at each corner of the site;
(iv) Name of the street upon which the site adjoins where applicable;
(v) Position of any service main and any connection point to the service main and of any sewer, storm water drain existing upon such site;

(vi) Position of the proposed building, existing building to be demolished (if applicable);

(vii) Any existing and intended point of access from any street, and any tree, street furniture, apparatus or equipment relative to the access.

SECTION 4: LAYOUT DRAWINGS

1.5.4.1. **Layout Drawings:** Any layout drawing prepared in accordance with these Regulations shall consist of as many plans, sections and elevations as may be necessary to indicate, where relevant, the position, form, dimensions and materials of the building proposed to be erected.

(i) The foundations, floors, walls, damp-proofing material, windows that are fixed or can be opened, fanlights, louvers and other ventilating devices, artificial ventilation systems, doors, stairs, roofs and chimneys shall be clearly shown on the plans, drawings or diagrams;

(ii) The layout drawings shall also indicate sanitary fixtures, structural members, the intended use of rooms and other spaces as well as the horizontal and vertical dimensions of the rooms and other spaces;

(iii) Where fixed seating is provided, the layout of all rows, seats and aisles, the position of all exit doors, and the total number of seats shall be shown on the plans;

(iv) The location, levels and size of any paved areas adjacent to the building shall be marked on the layout drawings;

(v) Where required by the Building Consent Authority, the layout drawings shall include the levels of any adjoining verge or roadway, together with a section along the length of any driveway, which shall show the relative levels and gradients of the driveway, and storm water drainage;

(vi) The Building Consent Authority office may require the levels of the floors relative to one another and to the existing ground surface, the proposed finished ground surface or the surface of any public place or public street to be marked on the layout drawings;

(vii) Where applicable, the details of any special provisions for persons with disabilities shall be given on all plans, drawings and diagrams.

SECTION 5: DRAINAGE INSTALLATION DRAWINGS PARTICULARS

1.5.5.1. **Drainage Installation Drawings and Particulars:** A drawing of the drainage installation as required by these regulations shall contain as many plans, sections and elevations as shall be necessary to show, where relevant:

(i) Position, size, gradient and any connecting point to the drain in relation to a datum established on the site and the level of the ground relative thereto;

(ii) Position of any point of access to the interior of any drain;

(iii) Position of any trapped gully;

(iv) Position and details of any septic tank, cesspool, soakage pit, conservancy tank, private sewage treatment plant or sewage pump;

(v) Position of any percolation test hole excavated on the site and any French drain;

(vi) Position and arrangement of any sanitary fixture served by the drainage installation;

(vii) Position and size of any soil pipe, waste pipe and ventilating pipe or device;

(viii) Positions of all openings in the building, such as chimneys, skylights, doors, windows, ventilation openings and air intakes that could permit the entry of foul air or gas into such building from any ventilating pipe or device; and

(ix) Position of any well, borehole or watercourse on the site which may be affected by any proposed soakage pit or French drain.

1.5.5.2. **Other submittals that may be required for drainage:** The Building Consent Authority office may require the owner to submit the following:

(i) Drainage design calculations, which shall clearly indicate the basis for such design;

(ii) An estimate of the composition and quantity of any industrial effluent proposed to be discharged into any sewer; and

(iii) Where approval has been given for the industrial effluent to be discharged into any sewer, plans and particulars of any drainage works and

installations as required by the relevant water, sewerage and environmental bodies in terms of the conditions of approval for such discharge.

Where abbreviations are to be used to signify details on drainage installation drawings, they shall be as indicated in the following list; Provided that where there may be a possibility of misunderstanding, the description shall be written in full:

Access opening	AO	Inspection eye	IE
Air valve	AV	Invert level	IL
Air release valve	ARV	Kitchen sink	KS
Bath	B	Manhole	MH
Bidet	BT	Non-return valve	NRV
Cast iron	CI	Pitch-impregnated fibre	PF
Check valve	CV	Rainwater pipe	RWP
Cleaning eye	CE	Reinforced concrete	RC
Cleaning eye	CE	Rodding eye	RE
Cold water down service Cold	CWDS	Shower	SW
water storage tank	CWST	Sink	S
Concrete	CONC	Slop hopper	SH
Copper	COP	Sluice valve	SV
Cover level	CL	Soil pipe	SP
Fibre cement	FC	Soil vent pipe	SVP
Flexible joint	FJ	Solar heating panel	SHP
Float valve	FV	Stainless steel	SS
Flow meter	FM	Stainless steel sink	SSS
Floor drain	FD	Storm-water channel	SC
Floor trap	FT	Storm-water pipe	SWP
Galvanized mild steel	GMS	Unplasticized polyvinyl chloride	uPVC
Gate valve	GV	Urinal	U
Ground level	GL	Vent or ventilating pipe	VP
Grease trap	GRT	Vitrified clay	VC
Gully	G	Washbasin	WB
Gully trap	GT	Wash hand basin	WHB
Hot water cylinder	HWC	Wash-trough (dhobi sink)	WT
Hot water service	HWS	Waste pipe	WP
Inspection chamber	IC	Water Closet pan	WC

SECTION 6: FIRE PROTECTION, STREET LEVELS & UNSTABLE SOILS

1.5.6.1. **Fire Protection Plans:** Where required by the Building Consent Authority office, a fire protection plan shall be submitted by the owner for approval with respect to the erection of any building not being a dwelling unit and shall clearly show the requirements for fire protection in relation to the classification of buildings.

1.5.6.2. **Symbols on Fire Protection Plans:** Where symbols are to be used to signify details on fire protection plans, they shall conform to symbols prescribed in the appropriate sections of this Code and additionally submitted as a separate sheet of symbols and abbreviations.

1.5.6.3. **Street Levels:** Where any building is to be erected on a site abutting a made street, the owner of the building shall, subject to the requirements of this Code, erect the building in accordance with the levels of such street. Where any portion of a street abutting the site on which any building is to be erected has not been made, the owner of the building shall obtain the proposed road levels from the Building Consent Authority.

1.5.6.4. The Building Consent Authority office shall provide the levels of unmade street within fourteen working days after the receipt of the request by the owner of the building. Where the Building Consent Authority office fails to provide the levels of unmade street, it shall notify the owner in writing to that effect, and the owner of the building shall determine the finished ground floor level of the building.

1.5.6.5. **Slopes and unstable soils:** The slope of cut or fill surfaces shall be no steeper than 2 units horizontal in 1 unit vertical (40% slope) unless a geotechnical engineering or an engineering geology report or both is furnished, stating that the site has been investigated and giving an opinion that a steeper slope will be stable and not create a hazard to public or private property. The construction of structures without a geotechnical study report shall be allowed on slopes not exceeding 30%.

SECTION 7: GRADING, EXCAVATIONS, FILLS, NOISE, DUST & SETBACKS

1.5.9.1. Appropriate erosion control measures shall be installed prior to any grading activity and shall be maintained in place until vegetation is established for suitable erosion and sedimentation control. Sediment from grading operations shall not be permitted to leave the site or enter any surface waters or wetlands.

1.5.9.1.1. All sites shall be cleaned upon project completion. Installation of permanent organic erosion control measures such as grass seeding, landscaping, or other organic means of erosion control shall be in place prior to final approval.

1.5.9.1.2. Cuts or fills of 2m in depth or greater shall be set back from property lines by a minimum of 8m. (Setback dimensions shall be horizontal distances measured perpendicular to the site boundary).

1.5.9.1.3. The ground surface shall be prepared to receive fill by removing all organic material, non-complying fill and scarifying topsoil.

1.5.9.1.4. Waste as defined in this Code and detrimental amounts of organic material shall not be used as fill material.

1.5.9.1.5. Dust and Noise: The owner of any permit where building operations are in progress shall take precautions in the working area, on surrounding roads, and on footways to limit to a reasonable level the amount of dust and noise arising from the operations.

1.5.9.1.6. The setting and height of buildings on any plot including setback for every zone within the requisite planning document(s) shall be adopted as set out and detailed in Zoning Regulations.

SECTION 11: GENERAL PLANNING, SITING OF BUILDING & PARKING

1.5.11.1. COMPLIANCE TO BASIC PHYSICAL PLANNING REQUIREMENTS

1.5.11.1.1. Any person intending to erect a new building or re-erect an existing building shall comply with the physical planning/local area development/zoning requirement of the area within which the project is to be implemented and such conditions as may be imposed by the Building Consent Authority regarding the siting, size, height, shape and appearance of such building in order to safeguard, maintain or impose the dignity or preserve the amenity and general appearance of street, square, public place or have effect on the complemented appearance of such street, square or public place.

1.5.11.2. SITING OF BUILDINGS

All new buildings shall be so sited on a plot as to ensure hygienic and sanitary conditions and to avoid as far as possible any nuisance or annoyance to the owners or occupiers of neighbouring plots.

1.5.11.3. ACCESS OF PLOTS

1.5.11.3.1. PERIMETER/BOUNDARY WALLS

Unless the Building Consent Authority otherwise agrees, the development of any plot shall include the provision of boundary walls, screen walls, fences or other means of enclosure of approved materials, construction and design.

1.5.11.3.2. HEIGHT OF PERIMETER/BOUNDARY WALLS

1.5.11.3.2.1. Boundary walls, screen walls, fences or other means of enclosure of residential plots shall not be erected to a height greater than 2.0m where abutting on to a street or in front of the building line of the main building, or in any other case.

1.5.11.3.2.2. All other external boundary walls, screen walls and fences shall be of such a height as the Building Consent Authority may require and shall use materials that allow at least 50% transparency.

1.5.11.3.2.3. Razor wire is not permitted in any residential area.

1.5.11.3.2.4. Razor wire, where permitted, may only be fixed at a minimum of 2.5m above ground level.

1.5.11.3.2.5. Broken glass and similar materials are not permitted on any building.

1.5.11.3.2.6. Electric fencing is not permitted on any residential building.

1.5.11.3.3. OBSTRUCTION TO VIEW

Nothing in this Code shall be deemed to authorize the formation, laying out or material widening of any means of access or any erection which creates an obstruction to the view of persons using any street used by vehicular traffic, at or near any bend, corner, junction or intersection so as to be likely to cause danger to such persons.

1.5.11.3.4. WAIVER AS TO THE HEIGHT

1.5.11.3.4.1. Where the ground on the line of a boundary wall or fence has such a slope or, in the opinion of the Building Consent Authority, on the grounds of privacy, amenity, safety or control, it is necessary or advisable to deviate from the heights prescribed in this Code, the Building Consent Authority may permit such other height as it considers adequate in the circumstances.

1.5.11.3.5. KERBSTONES

1.5.11.3.5.1. Every kerbstone shall be not less than 125mm in width, not less than 250mm in height and not less than 600mm in length.

1.5.11.3.5.2. Every kerbstone in a private street, access roads or cul-de-sac may be constructed of granite or concrete or any other approved material.

1.5.11.3.6. GRADE OF MANHOLE COVERS AND GRATINGS

1.5.11.3.6.1. Any manhole cover or grating situated in the carriageway of any private street, pedestrian sidewalk, cul-de-sac or access road shall be of a grade equal to grade of the top surface of the carriageway of any private street, pedestrian sidewalk, cul-de-sac or access road on which it is to be constructed.

1.5.11.3.7. SHAPE OF MANHOLE COVERS

1.5.11.3.7.1. The cover of every manhole, in a private street, cul-de-sac or access road, pedestrian way or service lane, provided for a drain or sewer provided for the carriage of foul water shall be rectangular on plan.

1.5.11.3.7.2. The cover of every such manhole provided for a drain or sewer provided for the carriage of surface water shall be rounded on plan.

1.5.11.3.8. DRAINAGE OF PRIVATE STREETS

1.5.11.3.8.1. Every private street, cul-de-sac, access road, pedestrian way and service lane shall be provided with channels, drains and sewers for the carriage of rain-water and surface water.

1.5.11.3.8.2. The size and gradient of every such channelled rain or sewer shall be adequate to carry off all rain-water falling on and surface water drainage to the private street, cul-de-sac, access road, pedestrian way or service lane.

1.5.11.3.9. BUILDINGS ABUTTING ON RETAINING WALLS

1.5.11.3.9.1. No domestic building shall be erected against a retaining wall which exceeds 4.5m in height.

1.5.11.3.9.2. A space not less than 1.5m in width shall be left between any domestic building and the bottom of any retaining wall exceeding 4.5m in height.

1.5.11.3.9.3. Retaining wall forming part of a building

1.5.11.3.9.4. Any retaining wall, which forms part of any domestic building shall:
(i) Be properly waterproofed to prevent dampness in the building; and

(ii) Be properly insulated to prevent condensation on the internal face of any room intended for habitation within the building.

1.5.11.3.10. Plot coverage, plot ratio and car parking:

(i) The Building Consent Authority shall determine the plot coverage and plot ratios depending on the zoning of the urban area and the level of urban services available;

(ii) Permitted plot coverage and plot ratio shall be as provided for in the zoning ordinance of the area within which the building is intended;

(iii) For the purpose of this Code, the plot coverage is defined as the percentage of the plot area occupied by the ground area of the primary and all ancillary buildings, parking structures and driveways;

(iv) For the purpose of these regulations, the plot ratio is defined as the gross floor area of the permittable building or buildings on any plot divided by plot area; and

(v) For the purpose of this Code, the gross floor area means the sum of the gross horizontal areas of all the floors of a building, measured from the exterior face of exterior walls or mid-point of common or party walls. The "floor area" of a building shall include basement floor area, staircase blocks, planter boxes and ledges, public areas such as landings, and common lobbies. It shall exclude floor area used for parking facilities. Basements not utilized for any habitable or commercial purposes shall be exempt from gross floor area calculations. Mechanical and Electrical floors with 1.5m or less headroom can be excluded from gross floor area computation.

Note: Any existing building not affected by the new development should clearly be stated in the existing gross floor area. Calculations of gross floor area for any development shall include the gross floor area of all existing developments within the plot.

1.5.11.3.11. PARKING

1.5.11.3.11.1. Parking for any building shall be provided depending on the gross floor area of the building or buildings.

1.5.11.3.12. OFF-STREET PARKING SPACES

1.5.11.3.12.1. Each off-street parking space provided for vehicles shall be as follows:

(i) For car, the minimum parking space to be 3m × 6m when individual parking space is required and 2.5m × 5m when common parking space is required;

(ii) Space for motor bikes/two wheelers and bicycles to be not less than 1.25m^2 and 1.00 m^2, respectively; and

(iii) Area for each equivalent car space inclusive of circulation area is 23m^2 for open parking, 28 m^2 for ground floor covered parking and 32m^2 for basement.

1.5.11.3.13. For buildings of different occupancies, off-street parking space for vehicles shall be provided as stipulated below:

(i) Other Types of Vehicles — For non-residential building, in addition to the parking areas provided in (i) above, 25 to 50 percent additional parking space shall be provided for parking other types of vehicles and the additional spaces required for other vehicles shall be as decided by the Building Consent Authority, keeping in view the nature of traffic generated in the city;

(ii) Off-street parking space shall be provided with adequate vehicular access to a street and the area of drives, aisles and such other provisions required for adequate manoeuvring of vehicle shall be exclusive of the parking space stipulated in these provisions; and

(iii) Apart from parking at ground level, provision of underground or multi-storeyed parking may be permitted. The parking of vehicles at different levels may also be mechanized. In the case of parking spaces provided in basement(s), at least two ramps of adequate width and slope shall be provided, located preferably at opposite ends. In case of

underground/multi-storeyed parking, special measures with regard to fire safety shall be taken.

SECTION 12: PLANNING FOR PERSONS WITH DISABILITY

1.5.12.1. All buildings shall be designed to the satisfaction of the Building Consent Authority in such a manner as will facilitate the access to, and use of, that building and its facilities by persons with disability. Buildings that have to comply with accessibility requirements for the disabled include all public buildings, governmental facilities and institutions, office buildings, residential buildings, commercial buildings, health facilities, educational institutions restaurants, recreational facilities, sports facilities, religious buildings and all other building types normally used by the general public.

1.5.12.2. Initial access for persons with disability -Access shall be provided from a point or points on the plot boundary to at least one entrance and to a lift such access shall be free from steps, kerbs other than dropped kerbs, steep ramps, doors or doorways which would impede the passage of a wheel chair or other form of barrier which would prevent access by the persons with disability.

1.5.12.3. Parking- Where car parking is provided, at least one car parking space or one percentage, whichever is the higher and as determined by the Building Consent Authority, of car parking space shall be accessible from the said entrance and lift. An additional space of 1.2 meters shall be provided and marked 'access zone' adjacent disabled parking spaces can share an access zone.

1.5.12.4. Ramps for persons with disability -at changes in level other than when served by a lift or at kerbs there shall be a ramp. Ramps shall be designed as follows: ramps shall be not less than 1.5m wide; a space not less than 1.5m square shall be provided at the head and foot of every ramp; where a ramp is at a gradient of 1 in 20 or steeper, a landing 1.5m long shall be provided for each 10m length of horizontal run or part thereof. Any ramp with a rise greater than 200mm, leading down towards an area where vehicular traffic is possible, shall have a railing across the full width of its lower end, not less than 1.5m from the foot of the ramp. No ramp shall be at a gradient exceeding 1 in 12. All ramps shall be provided with handrails on both sides. Supports shall not cause an obstruction to a height of 700mm above ramp level.

1.5.12.5. Dropped kerbs for persons with disability changes in level at kerbs shall be by a dropped kerb. Dropped kerbs shall be provided at pedestrian crossing and at each end of the footpath of a private street or access road. Kerbs separating footpaths or ramps from vehicular areas shall be dropped kerbs. Dropped kerbs shall be constructed as follows: the length of dropped kerbs shall be not less than 1.2m. The pavement at dropped kerbs shall be ramped at a gradient of less than 1 in 6 and there shall be a space of not less than 800mm wide at the back of the ramp. Kerbs adjoining dropped kerbs shall be ramped at a gradient of less than 1 in 6.

1.5.12.6. Lifts for persons with disability access shall be provided to every floor of the building by at least one lift having minimum internal car dimensions of 1.2m by 1.1m wide with a clear door width when opened of not less than 900mm, essential lift control buttons or switches not less than 900mm and not more than 1.2m above the floor of the car and handrails extending to within 150mm of the corners at the rear and sides of the car which are suitable for use by the persons with disability.

1.5.12.7. Corridors and lobbies for persons with disability space shall be allowed for manoeuvring wheel chairs in lobbies, paths and similar areas as follows: areas shall have a clear width of not less than 1.2m. A space not less than 1.5m square shall be provided at/ or within 3.5m of very dead end. Any lobby in a corridor shall be not less than 1.2m long excluding space for door swings. A level area, extending not less than 1.2m beyond the swings of the doors and not less than 1.5m wide shall be provided on both sides of every entrance which requires compliance, provided that this regulation shall not apply to lobbies which lead only to staircases.

1.5.12.8. Doors for use by the persons with disability shall comply with the following specifications: doors, including where applicable one leaf of a pair of double doors shall have a clear width of not less than 750mm between the open door and opposite jamb or other leaf. The unobstructed area adjacent to the door handle on the leading face of a single door shall not be less than 380mm wide. Doors, if less than 380mm from the corner of a room shall swing from the side nearer that

corner. Double-action self-closing doors shall have a check mechanism to prevent the doors swinging beyond the closed position and transparent panel with the bottom edge not more than 1m and the top edge not less than 1.5m above floor level. Door handles shall be not less than 900mm and not more than 1.05m above floor level, measured from the top surface of the grip. Door thresholds shall not exceed 25mm in height.

1.5.12.9. Water closet cubicles for persons with disability: The minimum number of water closet cubicles for use by the persons with disability on each floor level, or on that part of a floor level which is designed for access by the persons with disability shall be one where the total number of water closets provided on that level is 20 or less and 2 where the number of water closets exceeds 20. When water closet cubicles for use by the persons with disability are accessible from a corridor, the number of such cubicles shall be based on the number of water closets on the floor level or that part of a floor level which is designed for access by the persons with disability. When water closet cubicles for use by the persons with disability are accessible through a room with multiple cubicles, the number of such cubicles for each sex shall be based on the number of water closets for each sex on the floor level or that part of a floor level which is designed for access by the persons with disability.

1.5.12.10. Handrails for persons with disability: Handrails to ramps and steps shall be fixed not less than 30mm and not more than 50mm clear of walls and additionally or alternatively other obstructions and with a clear height of 70mm from the top of the bracket to the top of the handrail. The tops of handrails shall be of a height of not less than 850mm or more than 1 m above nosing, floor or landing level. Handrails shall extend horizontally not less than 300mm beyond the first and last nosing of every flight of steps or beyond the ends of a ramp.

1.5.12.11. Wheel chair spaces: There shall be provided in the auditorium of every building which is a place of public function such as entertainment, at spectator level with one wheel chair space for every 400 or part of 400 seats in the auditorium. For the purposes of this regulation a wheel chair space is a rectangle of 760mm by 1.37m

with a side of 760mm being toward the stage, podium or screen. Protection of balconies and verandas every balcony projected from an upper storey of a building shall have a clear height, upwards from the floor of such balcony, of not less than the clear height of the storey from which it projects.

1.5.12.12. Protection of openings: Every opening placed on an external wall above the ground floor of any building shall be protected by a barrier which shall not be less than 1.1m high. The lowermost 150mm of such barrier shall be built solid. It shall be so designed as to minimize the risk of persons or objects falling, rolling, sliding or slipping through gaps in the barrier, or persons climbing over the barrier. Buildings not to obstruct, endanger or cause nuisances no building or fixture thereon shall be so constructed that it: obstructs or endangers the users of any adjacent footpath or street or creates any nuisance; or permits the escape into or over any adjacent footpath or street at a height of less than 2.4m of any noxious gases or exhaust from any ventilating system.

1.5.12.13. Merchandise display areas: In accessible shops should be as conveniently located as possible to a wheelchair user. Angled mirrors can be placed above high shelves for visibility.

1.5.12.14. In accessible clothes shops: At least one changing room should allow for a full 360 degrees turn of a wheelchair.

SECTION 13: SUPERVISION & INSPECTION

1.5.13.1. SUPERVISION OF BUILDING ACTIVITIES

Authorized professional building supervisors shall ensure quality in building activities in accordance with provisions of the Building Code.

The following shall be the minimum scope of contracted services provided by building supervisors:

(i) Project management in accordance with administrative, legal and technical construction requirements;

(ii) Verify and certify designs before implementation;

(iii) Project management in accordance with approved designs;

(iv) Approval of design modifications and ensure obtaining of the necessary permits for modifications if needed;

(v) Ensure appropriate testing of materials, systems and installations for compliance with standards;

(vi) Technical and legal consulting;

(vii) Documentation, reporting and archiving of project details;

(viii) Approval of as-built drawings provided by contractors; and

(ix) Ensure public and on-site safety during construction and enforce building safety requirements.

1.5.13.2. Liability of supervising offices or qualified person in building activities :

Without prejudice of the above responsibilities, building supervising office or a qualified person shall be liable for non-compliance of the execution of the design during and after project implementation.

1.5.13.3. Conditions for providing authorization to supervising offices in building activities:

A technical supervising office shall fulfil the following conditions for authorization:

(i) to be a Registered Consulting firm or qualified individual;

(ii) to provide evidence of use of an accredited testing laboratory where necessary;

(iii) to be a firm with qualified and certified professionals in the specific fields relevant to the respective project;

(iv) to provide physical address of the firm; and

(v) to be certified by their respective professional bodies.

1.5.13.4. Inspections: Generally, all construction or work for which a permit is required shall be subject to inspection by the Building Consent Authority and Building Control Authority when deemed necessary and certain types of construction involving unusual hazards or requiring persistent inspection shall have random and continuous inspection by special inspectors appointed by the Building Consent Authority. Risk based inspections shall also be conducted basing on the nature and magnitude of the anticipated risk of the building.

1.5.13.5. The Building Inspectors: Within the Building Consent Authority entities there shall be a department of building inspection with competent experienced staff of different professional background as will be determined.

1.5.13.6. Outsourcing of Professional Inspectors: The work of a team of professionals may be outsourced by the Building Consent Authority from competent professionals as may be deemed necessary. The team shall ensure the compliance of laws, by-laws, natural lighting, ventilation, etc., besides structural and electrical safety. After checking, the team shall be required to give the certificate for the above aspects. If any shortcoming/deficiencies or violations are noticed during inspection, the Building Consent Authority shall ensure the compliance of these within a specified period of six months. If not complied with, the building shall be declared unsafe.

1.5.13.7. Inspection Requests: Whenever any work regulated by this Code, or any portion thereof is ready for inspection, the Building Official shall be notified by the permit holder that same is ready for inspection. The notice shall be submitted online where applicable or in writing on forms furnished by the Building Consent Authority having jurisdiction. The notice shall be filed with the Department of Building Inspection not less than forty-eight hours and not more than seventy-two hours before any such inspection is desired.

1.5.13.8. Void Inspections: Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this Code or of any other ordinance. Inspections presuming to give authority to violate or cancel the provisions of this Code or of any other ordinance shall not be valid. On the minimum the following sub- clauses provides highlights.

1.5.13.9. Accessibility: It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the building official nor the District Authority shall be liable for any expense entailed in the removal or replacement of any material required to allow inspection.

1.5.13.10. Inspection Requests: The building official shall proceed to inspect the same or to make inspection arrangements or notify the contractor of a reschedule within forty-eight hours, not including weekends or holidays, after receipt of such notice. When work conforms in all respects with the provisions of this chapter, a notice granting authority to proceed with installations shall be given.

1.5.13.11. Concealment of Works to be Inspected: No permitted work shall be covered or concealed until forty-eight hours have expired after a scheduled inspection or until the building official has approved the installation and given permission to cover or conceal the same. If the permitted work is covered or concealed without an inspection, the licensed contractor will provide verification that the concealed work complies with all the provisions of this chapter in a letter stamped and signed by an architect or structural engineer charged with the works. Should the building official condemn any of said work or equipment as not being in accordance with the provisions of this Code, notice in writing to that effect shall be given to the permit holder engaged in the work or posted at the jobsite.

(i) Within a reasonable time thereafter, the work or equipment shall be altered or removed as required and necessary changes shall be made so that all such work and equipment may fully comply with the provisions of this Code before further work is connected on or with the condemned work or equipment.

(ii) In default, where available the general supervisor and contractor shall be liable to the fines provided. Any owner who undertakes construction works without contracting services of a supervisor or a contractor shall be liable to the fines provided for this Code.

1.5.13.12. Required Inspections: To assure quality in building activities, public inspection is required on the following:

(i) Respect of public health, safety and general welfare;
(ii) Environmental protection;
(iii) Building faults provided for by relevant code elements;
(iv) Compliance of construction with the authorized plans and the Building Code and of progress within the required time frame;
(v) Compliance with technical supervision according to requirements.

1.5.13.13. Minimum Progressive Inspections: Not withstanding article 1.3.7.1 the building official, upon notification from the permit holder or the permit holder's agent, shall make the following inspection and shall either approve that portion of the construction as completed or shall notify the permit holder or the permit holder's agent if the same fails to comply with this code:

(i) Footing and foundation: Footing and foundation inspections shall be made after excavations if footings are complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. Materials for the foundation shall be on the job site;
(ii) Concrete slab and under-floor inspections: Concrete slab and under-floor inspections shall be made after in-slab or under-floor reinforcing steel and building service equipment, conduit, piping accessories and other ancillary equipment items are in place, but before any concrete is placed or floor sheathing installed, including the sub-floor;
(iii) Framing inspections: Framing inspections shall be made after the roof deck or sheathing, all framing, fire blocking and bracing are in place and

pipes, chimneys and vents to be concealed are complete and the rough electrical, plumbing, heating wires, pipes and ducts are approved;

(iv) Inspections: Lathing inspections to be made after all lathing and gypsum board, interior and exterior, in construction required to be fire-resistive is in place but before any plastering is applied or before gypsum board joints and fasteners are taped and finished; and

(v) Final inspection: The final inspection shall be made after all work required by the building permit is completed.

1.5.13.14. Inspection and Certification Reports: To every stage of inspection, the team of Building Officials shall make all the required inspections or it may accept reports of inspections of authoritative and recognized services or individuals, and all reports of inspections shall be in writing and certified by a responsible officer of such authoritative service or by the responsible individual or engage any such expert opinion as he may deem necessary to report upon unusual technical issues that may arise, subject to the approval of the Building Consent Authority.

1.5.13.15. Modification: Wherever practical difficulties are involved in carrying out any provision of the Code, the team of Building Officials may vary or modify such provisions upon application of the owner or his representative provided the spirit and intent of the Code shall be observed and public welfare and safety be assured. The application for modification and the final decision of the team of building officials shall be in writing and shall be officially recorded with the application for the permit in the permanent records of the Department of Building Inspection.

SECTION 14: CERTIFICATION PRIOR TO OCCUPANCY

1.5.14.1. No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made until the Building Official has issued a certificate of occupancy therefore as provided herein. The issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this Code or of other ordinances of the jurisdiction.

1.5.14.2. Occupancy Permit/Certificate issuance: After building completion and upon notification from the permit holder or the permit holder's agent, the owner/concerned registered architect/engineer/structural engineer will serve a notice/completion certificate to the Building Consent Authority in form of application for Occupation Permit and Freehold Title attesting that the building has been completed in accordance to the approved plans and in total compliance with building regulations. The deviations shall also be brought to the notice of the Building Consent Authority (with relevant documents). The team of building inspection officials and the focal persons/staff from different bodies or its duly authorized representative shall then visit the site for verification. After the building officials has received notification from accredited supervising engineer or firm attesting that the building or structure has been built as per the approved plans by the Building Consent Authority and finds no violations of the provisions of this Code or other laws that are enforced by the Code, the Building Official shall issue an occupancy permit. The Occupancy Permit should clearly state the use/type of occupancy of the building.

1.5.14.3. Change of use/occupancy: However, the applicant can apply for change of use/occupancy permitted within the purview of the Master Plan/Building Bylaws, where so required.

1.5.14.4. Periodic Occupancy Inspection: After completion of the building and obtaining the occupancy certificate, all occupied buildings except dwelling house classified under R-5 (see Table of Use and Occupancy Classification) shall be subjected to periodic inspections by the Building Consent Authority to ensure the fire safety of the building and compliance with the provisions of fire and life safety requirements.

1.5.14.5. Obligation of the owner: The owner has the obligation to request the inspection.

SECTION 15: VIOLATIONS, OFFENCES, STOP WORK ORDERS & FINES

Any person who contravenes any of the provisions of this Code or any requirements, obligations imposed on him by virtue of this Code, or who interferes with or obstructs any person in the discharge of his duties, shall be guilty of an offence and shall be liable to the sanctions provided for in the Ministerial Order Determining Urban Planning and Building Regulations.

1.5.15.1. Fines: Any person who performs any building activities without authorization shall be liable to penalties as provided for in the Ministerial Order Governing Urban Planning and Building Activities.

1.5.15.2. Further Sanctions of the Offender: The conviction of any person for an offence under the provision of 1.5.15.1 shall not relieve him from the duty of carrying out the requirements or obligations imposed on him by virtue of the provisions of the Code. If such requirements or obligations are not complied with in accordance with an order made under provisions of 1.5.15.1, the Building Consent Authority acting under the provisions of the Code may, if necessary and advisable, enter upon the premises in respect of which a violation has been made and carry out at the expense of the convicted person, the requirements or obligations referred to in the said order and the expense and if not paid on demand, the amount may be recovered with cost in a court.

1.5.15.3. Unlawful acts: It shall be unlawful for any person, firm or corporation to erect, construct, alter, extend, repair, move, remove, demolish or occupy any building, structure or equipment regulated by this Code, or cause same to be done, in conflict with or in violation of any of the provisions of this Code.

1.5.15.4. Notice of violation: The Building Consent Authority or the Building Control Authority as the case may be, shall serve a notice of violation or order in writing on the person responsible for the erection, construction, alteration, extension, repair, removal, demolition, use or occupancy of a building or structure in violation of the provisions of this Code, or in violation of a detail statement or a plan approved there under, or in violation of a permit or certificate issued under the provisions of this Code. Such order shall direct the discontinuance of the

unlawful act and the abatement of the violation and shall be complied with, within twenty-one (21) working days.

1.5.15.5. Sanction for violation: If the notice of violation is not complied with promptly, the building official is authorized to institute appropriate proceedings in law or in equity to restrain, correct or abate such violation or to require the removal of or termination of the unlawful occupancy of the building or structure in violation of the provisions of this Code or of the order or direction made pursuant thereto.

1.5.15.6. Temporary Structures Violation: Where plans and details have not been submitted to the Building Consent Authority office or where the Authority has refused to grant approval of the plans and details, the owner shall demolish and remove the building without any compensation.

1.5.15.7. Occupancy violations: Wherever any building is being used contrary to provisions of the Code, the Building Consent Authority may order such use discontinued and the building or portion thereof, vacated by the notice served on any person causing such use to be discontinued.

1.5.15.8. Stop Work Order: Upon notice from the Building Consent Authority that work on any building or structure is being carried out contrary to the provision of this Code, or in an unsafe and dangerous manner, such work shall be immediately stopped. The Stop Work Order shall be in writing and shall be given to the owner of the property involved or to the owner' s agent or to the person doing the work, and shall state the conditions under which work will be permitted to resume. No further work shall continue on any building work on which a Stop Work Order has been served unless the order is revoked in writing. Any person who shall continue any work in or about the structure after having been served with a Stop Work Order except work that has been instructed as abatement shall be liable to a fine as stipulated in 1.5.15.2

1.5.15.9. Quit premises order: Whenever any building or structure regulated by this code is being used contrary to the provisions of this Code, or has been declared unsafe, dangerous and unsuitable for habitation, or is slated for demolition, or is being used in a manner as to constitute nuisance or hazard, the Building Consent

Authority may order the building or structure or parts thereof vacated by serving a quit premises order to the owner or any person occupying the building or structure.

SECTION 16: UNSAFE STRUCTURES

1.5.16.1. Unsafe building: All unsafe buildings shall be considered to constitute danger to public safety and shall be restored by repairs or demolished or dealt with as otherwise directed by the Building Consent Authority.

1.5.16.2. Examination of Unsafe Building: The Building Control Authority shall examine or cause to be examined every building reported to be unsafe or damaged, and shall make a written record of such examination.

1.5.16.3. Notice to Owner, Occupier: Whenever the Building Control Authority finds any building or portion thereof to be unsafe, it shall, in accordance with established procedure for legal notice, give to the owner and occupier of such building written notices stating the defects thereof. This notice shall require the owner or the occupier within a stated time either to complete specified repairs or improvements or to demolish and remove the building or portion thereof.

1.5.16.4. Scope of eminent domain: The Building Control Authority may direct in writing that the building which in his opinion is dangerous, or has no provision for exit if caught fire, shall be vacated immediately or within the period specified for the purpose; provided that the Building Consent Authority concerned shall keep a record of the reasons for such action. If any person does not comply with the orders of vacating a building, the Building Consent Authority may direct request the assistance of the eminent domain to forcefully remove the person from the building.

1.5.16.5. Disregard of Notice: In case the owner or occupier fails, neglects, or refuses to comply with the notice to repair or to demolish the said building or portion thereof, the Building Consent Authority shall cause the danger to be removed whether by demolition or repair of the building or portion thereof.

1.5.16.6. Cases of Emergency: In case of emergency, which in the opinion of the Building Consent and/or Building Control Authority involves imminent danger to human life or health, the decision of the Building Control Authority shall be final:

(i) The Building Consent and/ or Building Control Authority shall forthwith or with such notice as may be possible cause such building or portion thereof to be rendered safe by retrofitting/strengthening to the same degree of safety or be removed.

(ii) For this purpose, the Building Consent and/or Building Control Authority may at once enter such structure or land on which it stands, or abutting land or structure, with such assistance and at such cost as may be deemed necessary.

(iii) The Building Consent Authority and/or Building Control Authority may also get the adjacent structures vacated in order to protect the public by an appropriate fence or such other means as may be necessary.

1.5.16.7. Costs: Costs incurred under 1.5.16.4 and 1.5.16.5 shall be charged to the owner of the premises involved. Such costs shall be charged on the premises in respect of which or for the benefit of which the same have been incurred and shall be recoverable as provided under the laws.

SECTION 17: FORMS

FORM 1: FORM FOR CERTIFICATE FOR STRUCTURAL DESIGN SUFFICIENCY

With respect to the building work of erection, re-erection or for making alteration in the building on Plot No.....in District…….....Sector ..... Cell.....Village .....we certify that the structural plans and details of the building submitted for approval satisfy the structural safety requirements for all situations including natural disasters, as applicable and as stipulated under Part 6 Structural Design of the Building Code of Rwanda and other related approved standards ; and the information given therein is factually correct to the best of our knowledge and understanding.

Signature of owner with date Registered

Engineer/Structural Engineer with date and registration No.

Name: .....

Address: .....

FORM 2: FORM FOR CERTIFICATE FOR ELECTRICAL DESIGN SUFFICIENCY

With respect to the building work of erection, re-erection or for making alteration in the building on Plot No.....in District…….....Sector ..... Cell.....Village .....we certify that the electrical plans and details of the building submitted for approval satisfy the electricity safety requirements as stipulated in chapter 4 building service of the Building Code of Rwanda and other related approved standards ; and the information given therein is factually correct to the best of our knowledge and understanding.

Signature of owner with date Registered

Electrical Engineer with date and registration No.

Name: .....

Address: .....

FORM 3: FORM FOR SUPERVISION

I hereby certify that the development, erection, re-erection or material alteration in/of building on Plot No.....in District…….....Sector ..... Cell.....Village .....shall be carried out under my supervision and I certify that all the materials (type and grade) and the workmanship of the work shall be generally in accordance with the general and detailed specifications submitted along with, and that the work shall be carried out according to the sanctioned plans.

Signature of Architect/Engineer/Structural Engineer/Supervisor//Urban/Town Planner /Landscape Architect/Urban Designer1).....

Name of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer1)..... (in block letters)

Registration No. of Architect/Engineer/Structural Engineer/Supervisor/Urban/Town Planner/Landscape Architect/Urban Designer1).....

Address of Architect/Engineer/Structural Engineer/Supervisor//Urban/Town Planner/Landscape Architect/Urban
Designer1).....

Date: .....

FORM 4: FORM FOR SANCTION OR REFUSAL OF DEVELOPMENT/BUILDING PERMIT

To

.....

.....

.....

Sir,

With reference to your application no.....dated .....for grant of permit for the development, erection, re-erection or material alteration in the building on plot No. .....in District…….....Sector ..... Cell.....Village .....I have to inform you that the sanction has been granted/refused by the Building Consent Authority on the following grounds:

1.

2.

3.

4.

Office Stamp.....

Signature of the Building Consent Authority Authorized Officer.....

Office (Communication) No. .....

Name, Designation and Address of the Building Consent Authority Authorized Officer.....

Date: .....

FORM 5: FORM FOR CERTIFICATE FOR EXECUTION OF WORK AS PER STRUCTURAL SAFETY REQUIREMENTS

With respect to the building work of erection, re-erection or for making alteration in the building on plot No. .....in District……...Sector ..... Cell.....Village ..... we certify:

(a) that the building has been constructed according to the sanctioned plan and structural design (one set of drawings as executed enclosed), which incorporates the provisions of structural safety as specified in Part 6 'Structural Design' of the Building Code of Rwanda and other relevant Codes; and

(b) That the construction has been done under our supervision and guidance and adheres to the drawings and specifications submitted and records of supervision have been maintained.

Any subsequent changes from the completion drawings shall be the responsibility of the owner.

Signature of the Registered Engineer/Structural Engineer with date and registration No.

Signature of owner with date:

Name: .....

Address: ....

FORM 6: FORM FOR COMPLETION CERTIFICATE

I hereby certify that the development, erection, re-erection or material alteration in/of building on plot No. .....in District……....Sector ..... Cell.....Village ..... has been supervised by me and has been completed on ..... according to the plans sanctioned, on permit No. ..... Dated..... The work has been completed to my best satisfaction, the workmanship and all the materials (type and grade) have been used strictly in accordance with general and detailed specifications. No provisions of the Code, no requisitions made, conditions prescribed or orders issued thereunder have been transgressed in the course of the work. The land is fit for construction for which it has been developed or re-developed or the building is fit for use for which it has been erected, re-erected or altered, constructed and enlarged.

I hereby also enclose the plan of the building completed in all aspects.

Signature of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer 1).....

Name of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer1).....(in block letters)

Registration No. of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer1).....

Address of Architect/Engineer/Structural Engineer/Supervisor/Town Planner/Landscape Architect/Urban Designer 1).....

Date: ..... Signature of the Owner.....

1Strike out whichever is not applicable.

FORM 7: FORM FOR OCCUPANCY PERMIT AND FREEHOLD TITLE

The work of erection, re-erection or alteration in/of building on plot No. .....in District……....Sector .....Cell.....Village ..... completed under the supervision of.....Architect/Engineer/Structural

Engineer/Supervisor, Registration No.....has been inspected by me. The building can be permitted/not permitted for occupation for .....occupancy subjected to the following:

1.

2.

3.

One set of completion plans duly certified is returned herewith.

Signature of the Building Consent Authority Authorized Officer.....

Office Stamp

Date: .....

FORM 8: FORM FOR APPLICATION FOR PERMIT TO ERECT,RE-ERECT OR ALTER ADVERTISING SIGN

1. Type of sign.....

2. Location:

a) Building/premises.....

b) Location of building/premises with respect to neighbouring streets.....

3. Dimensions and details of the sign.....

4. Materials used for different parts.....

5. Electrical and lighting details.....

6. Structural details showing also supporting framework and anchorages.....

7. Mode of operation.....

Name and address of the applicant.....

Name and address of the owner of the building/premises.....

Signature.....

FORM 9: FORM CERTIFYING PROPER PERMIT APPLICATION ASSESSMENT FOR NON-OBJECTION

With respect to the duties of Building Consent Authority, we..... on behalf of the District One Stop Centre of ……. District; certify that the permit application file of ……..... located in …… Sector ..... Cell.....Village; was appropriately assessed and was found complete and deserving a permit. We further certify that the drawings, designs and details of the application submitted for non-objection satisfy the provisions of the Rwanda Building Code and other related approved standards; and the information given therein is factually correct to the best of our professional liability.

Date & Signature

On …….

Name: .....

Mobile Line.....

Director of …… One Stop Centre

REPUBLIC OF RWANDA

CHAPTER 2:

STRUCTURE&BUILDING MATERIALS

RWANDA BUILDING CODE

Chapter Two:
STRUCTURE & BUILDING MATERIALS

PART 6: STRUCTURE

PART 7: BUILDING MATERIALS

RWANDA BUILDING CODE

Chapter Two:
STRUCTURE & BUILDING MATERIALS

PART 6:

STRUCTURE

CONTENTS

CHAPTER 2: STRUCTURE & BUILDING MATERIALS

PART 6: STRUCTURE

SECTION 1: GENERAL DESIGN REQUIREMENTS

2.6.1.1. Any building and/or any structural element or component shall be designed to provide strength durability and serviceability in line with accepted principles of structural design and such that it does not harm the integrity of any other building or property.

2.6.1.2. Any such building (see 2.6.1.1 above) shall be so designed to avoid progressive or disastrous collapse that is disproportionate to the original cause in case of accidental over-loading.

2.6.1.3. Every building and structural element or component shall be designed based on the code provisions.

2.6.1.4. Every building and every structural element shall be designed according to the appropriate occupancies classification provided in Part 4 of this Code.

2.6.1.5. Design responsibility of any structure or structural system shall be done according to the requirements of this code

2.6.1.6. Design considerations for people with disabilities shall be done in accordance with RS 115.

2.6.1.7. Design risk assessment shall include the risks associated with the initial works, the buildability and building programme as well as the use, operation and maintenance of the building or structure and demolition at the end of its lifespan.

2.6.1.8. The designers shall indicate and recommend the materials to be used in the building of any structure or structural system or its elements or components thereof according to the material requirements in relevant parts in Part 7 of this Code.

SECTION 2: LOADS, FORCES & EFFECTS

The following types of loads and/or their combination must be considered in structural design: dead loads, live loads (imposed loads), dynamic loads (wind loads, thermal loading, seismic loads and other dynamic loads), lateral soil pressure and special loads.

2.6.2.1. DEAD LOADS

2.6.2.1.1. For the purpose of calculating the dead load of a building or any part of a building, the weights of all building material shall conform to RS 106 and RS 114-1. In the case of materials not mentioned in this standard, the weights shall be determined by tests to be carried out by an accredited laboratory.

2.6.2.1.2. Where the positions of permanent partitions are shown on the plans furnished to the Building Consent Authority, the weight of the partitions shall be included as dead load.

2.6.2.1.3. Where it is intended to erect partitions which are not shown on the plan, the beams and the floor slabs, where they are capable of distributing the load effectively over the area of floor, shall be designed to carry, in addition to other loads, a uniformly distributed load per square meter of not less than 30% of the weight per meter run of the finished partitions or in the case of a floor being used as an office, the design shall be based on the calculated load or a load of $1kN/m^2$, whichever is greater.

2.6.2.1.4. The weights of tanks and any other containers positioned on buildings and of their contents shall be considered as dead loads calculated when a tank or container is full.

2.6.2.2. IMPOSED LOADS

2.6.2.2.1. The imposed loads on the floors, stairs, landings, corridors, balconies, beams, columns, piers, walls, structural frames or any other parts of the building shall be derived in accordance with RS 106 and RS 114-1, whichever proves more onerous, and where it is known that the actual imposed loads shall exceed those derived, the higher loads shall be adopted in the design.

2.6.2.2.2. Floors must be designed so that they are capable to carry both distributed and concentrated imposed loads. The concentrated loads shall be applied in the positions which will cause the maximum stresses and maximum deflections.

2.6.2.2.3. In the design of columns, piers or walls supporting two or more floors in any building other than plant or machinery or in building designed for storage purpose, the total imposed floor loads calculated in sub-regulation 2.6.2.2.1 may be reduced by the percentage specified in Table 2.6.2-1 for a factory or a workshop. The minimum total imposed floor load for any column, pier or wall shall not be less than 5kN/m^2 on all floors supported.

Table 2.6.2-1: Load Reduction on Columns

Number of Floors Supported	Percentage Reduction
1	0
2	10
3	20
4	30
5 to 10	40
Over 10	50

2.6.2.2.4. Where a single span of a beam supports not less than 50m^2 of floor area at one general level and the floor shall not be used for storage purposes, the imposed loads as calculated in sub-regulation 2.6.2.1.3 for the design of the beam may be reduced by 5% for each 50m^2 of supported floor, subject to a maximum reduction of 25%; a similar reduction may be taken into account in the design of any column, pier or wall supporting the beam.

2.6.2.2.5. For the design of roofs, the following imposed loads shall be allowed in addition to wind and dead loads:

(i) On roofs where access is provided, an imposed load shall be determined based on design assumptions.; and

(ii) On roofs where access is not provided other than for maintenance, an imposed load of 0.5kN/m^2 shall be taken.

2.6.2.2.6. For sloping roofs with slopes greater than 10° where access has not been provided, the following shall apply:

(i) On roofs with slopes shallower than, or equal to 30°; 0.5kN/m^2 imposed load shall be taken; and

(ii) On roofs with slopes greater than 30° but less than 45°; imposed loads shall be interpolated linearly at 30° and 0kN/m^2 at 45°.

2.6.2.2.7. All roof covering and purlins shall be capable of carrying a minimum load of 1kN concentrated on an area of 100mm^2 at any point except that where the roof slope exceeds 45°, a concentrated load of 0.5kN shall be provided. Any load specifically allowed for plant or machinery shall not be reduced.

2.6.2.3. DYNAMIC LOADING

2.6.2.3.1 WIND LOAD

2.6.2.3.1.1. When designing buildings, structures and any other structural components, the wind load shall be considered. All the wind actions acting on the building shall be calculated in accordance with RS 114-2.

2.6.2.3.1.2. The grades of exposure to wind shall be in accordance with Table 3 in RS114-2

2.6.2.3.1.3. SEISMIC LOADS

2.6.2.3.1.4. The design for seismic loads shall be carried out in order to prevent all the impairments which may occur when those forces happen. The design of all building structures shall conform to the seismic loading and design requirements specified in RS 112 and ISO 3010.

2.6.2.3.1.5. Building structures shall be designed for forces generated by a maximum credible earthquake having peak ground acceleration equal to 2.5m/s^2, which has a 10% probability of exceed in 50 years and a return period of 500 years. Approval for such structure shall not be granted without the explicit scrutiny of the design and signature of a qualified person.

2.6.2.3.1.6. In computing the effect of seismic forces in combination with vertical loads, gravity load stresses induced in members by dead load with the design live load, except roof live load, shall be considered. Consideration shall also be given to minimum gravity loads acting in combination with lateral forces in reference to RS112.

2.6.2.3.2. DYNAMIC LOADS DUE TO IMPACT & VIBRATION

2.6.2.3.2.1. The dynamic loads resulting from rotating and/or vibrating machines, braking and acceleration of forklift trucks and any other dynamic loads due to crowds shall be considered in the structural design regarding their magnitude.

2.6.2.3.2.2. Design for dynamic loads resulting from vehicular movement in building shall be in accordance with RS 114-1. It shall include the vertical loads, eccentricity effects induced by vertical loads and impact factors.

2.6.3.4. THERMAL LOAD

When designing buildings, structures and any other structural components, the thermal load shall be considered. All the thermal actions acting on the building shall be calculated in accordance with RS 114-3

LATERAL SOIL PRESSURE

2.6.2.3.3. The pressure exerted by the soil or water or both in the designing of structures of parts or structures under ground level like retaining walls and other walls in basement floors shall be duly accounted for and the lateral earth pressure shall be evaluated for weight of soil diminished by buoyancy and the full hydrostatic pressure in reference to RS113.

2.6.2.3.4. The requirements for soil pressure for flexible retaining walls or for propped walls where little movement is anticipated shall be in accordance with RS 113.

2.6.2.4. LOAD COMBINATIONS

2.6.2.4.1.1. All appropriate loads shall be considered, including both earthquake and wind, in accordance with the specified load combinations. Each load combination shall also be investigated with one or more of the variable loads set to zero.

2.6.2.4.1.2. The load combinations and partial safety factors to consider in the design shall comply with RS 112.

2.6.2.5. SPECIAL LOADS

2.6.2.5.1. The special loads such temperature effects, internally generating stresses (due to creep, shrinkage, differential settlement), accidental loads, hydrostatic fatigue and soil pressure shall be suitably taken into account in the design of buildings.

2.6.2.5.2. During construction, the suitable provisions shall be made, including temporary bracings in order to sustain all the erection loads and considering that dead load, wind load and imposed loads as would be imposed on a structure during construction, act together with erection loads.

SECTION 3: GEOTECHNICAL REQUIREMENTS & FOUNDATIONS

2.6.3.1.1. SOILS

2.6.3.1.1.1. GENERAL REQUIREMENTS

2.6.3.1.1.2. For construction of a storeyed building or any heavily loaded foundations, the application for building shall be submitted to the Building Consent Authority; including soil testing documentation (in relation to 2.6.3.1.2 and 2.6.3.1.3) in accordance with relevant parts of RS ISO/TS 17892. And any sub-soil exploration shall be ordered and supervised by a qualified and competent person.

2.6.3.1.1.3. The depth of sub-soil exploration shall depend on the type of proposed structure, its total weight, the size, shape and disposition of the loaded areas, soil profile and the physical properties of the soil that constitutes each individual stratum.

2.6.3.1.1.4. Design requirements for slope stability and risk factors such as soil type, groundwater, surface water, surcharging, and guidance on remediation measures shall comply with RS 113.

2.6.3.1.2. SITE INVESTIGATION

2.6.3.1.2.1. The minimum ground investigation requirements shall be comprised of bearing capacity, soil classification, plasticity tests, Unterberg limit, water table, friction coefficient, sliding coefficient, recommendation on the adequate type of foundation with maximum permissible depth done in accordance with RS113.

2.6.3.1.2.2. Detailed survey shall be conducted to ascertain the topography of the existing ground and shall be carried out for identification, location, alignment and depth of various utilities below the surface of the existing ground level.

2.6.3.1.2.3. Before constructing a new building and structure or for alteration of the foundation of an existing structure, subsoil investigation shall be done by describing the character, nature, load bearing capacity and settlement capacity of the soil.

2.6.3.1.2.4. For new works, the ground investigation shall obtain reliable information to produce an economic and safe design, to assess any physical or chemical hazard associated with the ground and construction requirements.

2.6.3.1.2.5. In areas which have already been developed, the information shall be made and be used for designing foundation of lightly loaded structures of not more than two storeys and also for deciding scope of further investigation for other structures.

2.6.3.1.2.6. The locations of investigation points, pits and boreholes shall be selected on the basis of the preliminary investigations as a function of the geological conditions, the dimensions of the structure and the engineering problems involved.

2.6.3.1.3. GEOTECHNICAL INVESTIGATION REPORT

2.6.3.1.3.1. The results of a geotechnical investigation shall be compiled in the geotechnical investigation report. The geotechnical investigation report shall consist of the following:

(i) A presentation of all appropriate geotechnical information on field and laboratory tests including geological features and relevant data; and

(ii) A geotechnical evaluation of the information, stating the assumptions made in the interpretation of the test results.

(iii) The geotechnical investigation report shall state known limitations of the results as appropriate. The geotechnical investigation report shall propose necessary further field and laboratory investigations, with comments justifying the need for this further work. Such proposals shall be accompanied by a detailed programme for the further investigations to be carried out.

2.6.3.1.3.2. The presentation of geotechnical information shall include a factual account of all field and laboratory investigations. The factual account shall include the following information:

(i) The purpose and scope of the geotechnical investigation including a description of the site and its topography;

(ii) Of the planned structure and the stage of the planning the account is referring to;

(iii) The names of consultants and contractors;

(iv) The dates between which field and laboratory investigations were performed; and

(v) The field reconnaissance of the site of the project and the surrounding area noting particularly:

a. Evidence of groundwater;

b. Behaviour of neighbouring structures;

c. Exposures in quarries and borrow areas;

d. Areas of instability;

e. Difficulties during excavation;

f. History of the site;

g. Geology of the site;

h. Survey data with plans showing the structure and the location of all investigation points;

i. Local experience in the area; and

j. Information about the seismicity of the area.

2.6.3.1.3.3. The presentation of geotechnical information shall include documentation of the methods, procedures and results including all relevant reports of:

(i) Desk studies;

(ii) Field investigations, such as sampling, field tests and groundwater measurements; and

(iii) Laboratory tests.

2.6.3.1.3.4. The results of the field and laboratory investigations shall be presented and reported according to the requirements specified in the RS ISO/TS 17892-2.

2.6.3.1.4. SOIL CLASSIFICATION & IDENTIFICATION

2.6.3.1.4.1. The classification of the soil under all portions of every building shall be based upon the examination of adequate test borings and/or excavations made at the site and shall be in accordance with relevant parts of RS ISO 14688.

2.6.3.1.4.2. The principles for classification and identification of soil shall follow the guidelines of RS ISO 14688-2 and Table 2.6.3-1 for bearing capacities.

Table 2.6.3-1 General Classification & Design Bearing Capacities of Rocks & Soils

Category	Type of Rocks/Soils	Presumed Allowable Building Capacities (kPa)
Rocks	Strong igneous and gneissic rocks in condition	10,000
	Strong limestone and sandstones	4,000
	Schist and slates	3,000
	Strong shale, mudstones and siltstones	2,000
	Soft weathered rocks	600
Cohesion-less Soils	Dense gravel or dense sand and gravel	> 600
	Medium dense gravel or medium dense sand and gravel	< 200 to 600

	Loose gravel or loose sand and gravel	< 200
	Compact sand	> 300
	Medium dense sand	75 300
	Loose sand	< 100
Cohesive Soils	Very stiff and hard clays	300 to 600
	Stiff clays	150 to 300
	Firm clays	75 to 150
	Soft clays	< 75
Peat and Organic Soils		Not applicable

2.6.3.1.4.3. A specific sampling category shall be selected in order to achieve a required sample quality class according to RS ISO 22475-1 and care shall be taken in protecting, handling and subsequent transport of samples and shall be labelled, so that they can be received in a fit state for examination and testing, and can be correctly recognised as coming from a specified trial pit.

2.6.3.1.4.4. The allowable bearing pressure shall be calculated using field method in accordance with RS 113.

2.6.3.1.4.5. Any building constructed on unstable soils and difficulty soils shall depend on guidelines of Part 5 Section 8 and shall be approved by the Building Consent Authority.

2.6.3.2. EXCAVATION

2.6.3.2.1. GENERAL REQUIREMENTS

2.6.3.2.1.1. Where any excavation related to a building is carried out or is to be carried out on any site the owner of that site shall notify the Building Consent Authority of that intention to excavate as required in Part 5 Section 9 of this Code.

2.6.3.2.1.2. Where the depth at any point in an excavation is expected to be in excess of 3m, which is not indicated on the approved plans, the owner of the site shall:

(i) Make an application to the Building Consent Authority, in writing, for authorization prior to the commencement of the excavation;
(ii) Take precautionary measures as may be specified by the Building Consent Authority; and
(iii) Maintain an open excavations in a safe condition at all times to the satisfaction of Building Consent Authority office.

2.6.3.2.2. GENERAL REQUIREMENTS

2.6.3.2.2.1. Where any excavation related to a building is carried out or is to be carried out on any site the owner of that site shall notify the Building Consent Authority of that intention to excavate as required in Part 5 Section 9 of this Code.

2.6.3.2.2.2. Where the depth at any point in an excavation is expected to be in excess of 3m, which is not indicated on the approved plans, the owner of the site shall:

(iv) Make an application to the Building Consent Authority, in writing, for authorization prior to the commencement of the excavation;
(v) Take precautionary measures as may be specified by the Building Consent Authority; and
(vi) Maintain an open excavations in a safe condition at all times to the satisfaction of Building Consent Authority office.

2.6.3.2.2.3. Any excavation exceeding 3m below the original ground level or in situations where special geotechnical considerations exist, shall be designed by a qualified person.

2.6.3.2.2.4. The minimum slopes for permanent fill and cut slopes for permanent excavations shall be 50%. The Building Consent Authority shall permit the foregoing limitation for cut slope upon the soil investigation report.

2.6.3.2.2.5. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of 5% for a minimum distance of 3.1m measured perpendicular to the face of the wall. Impervious surfaces within 3.1m of the building foundation shall be at minimum slope of 2% away from the building.

2.6.3.2.2.6. Safety measures for excavation shall comply with regulations of Part 12 of this Code.

2.6.3.2.3. EXCAVATIONS FOR FOUNDATIONS

2.6.3.2.3.1. Stumps and roots shall be removed from the soil to a depth of at least 0.3m below the surface of the ground in the area to be occupied by the building

2.6.3.2.3.2. In water logged areas, the excavation depth shall be extended according to the water table depth of the site location as specified during the site investigation and testing in accordance with RS113.

2.6.3.2.3.3. An excavation for a foundation shall be taken down to a natural ground which provides a suitable formation level, subject to assumptions made during foundation design, and the bottom made horizontal. This shall be indicated on the plans submitted.

2.6.3.2.3.4. To avoid foundation settlement and lateral translation, no removal of foundations lateral support shall be done without first of all underpinning them near the excavation on which the work is being carried out.

2.6.3.2.3.5. Where any foundation is placed on solid rock, the bearing area shall be cleaned so as to prevent lateral movement of such foundation.

2.6.3.2.3.6. The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with controlled low strength Materials.

2.6.3.2.3.7. Materials required for excavation such as ropes, planks for gangways and walkways and ladders, shall be inspected by the qualified and competent person who shall ensure that no accident shall occur due to the failure of such materials.

2.6.3.3. FOUNDATION

2.6.3.3.1. GENERAL REQUIREMENT

2.6.3.3.1.1. The foundation of every building shall be designed and constructed so as to sustain any kind of loading (static and vertical combination of dead and imposed loads of the building, dynamic loads, lateral loads) and to transmit these loads to the ground in such a manner that the pressure on the ground shall not cause settlement to impair the stability of the building or of adjoining works or any type of foundation specified in sub-regulations 2.6.3.3.4, 2.6.3.3.5 and 2.6.3.3.6 of this Section.

2.6.3.3.1.2. Footings supported on soil shall be embedded sufficiently below the maximum computed scour depth or protected with a scour counter measure.

2.6.3.3.1.3. Foundation shall be so designed that the allowable soil capacity is not exceeded, and the total and differential settlement are within permissible values.

2.6.3.3.1.4. The machine foundation shall satisfy the criteria for dynamic loading in addition to that for static loading.

2.6.3.3.1.5. Where eccentric loading of foundation to a wall, column or pier occurs, the member shall be suitably designed to resist overturning moment.

2.6.3.3.1.6. A foundation in any type of soil shall be below the zone significantly weakened by root holes or cavities produced by burrowing animals or works. The depth shall also be enough to prevent the rainwater scouring below the footings.

2.6.3.3.1.7. The foundation for a load bearing member of a building, where constructed as a strip foundation in plain concrete and situated centrally under a wall or pier, shall be deemed to satisfy the following requirements:

(i) There shall be no wide variation in the type of soil over the loaded area and no weak soil types shall exist below that on which the foundation rests within a depth equal to the foundation width as it may impair the stability of the structure;

(ii) The foundation shall be designed so that the maximum pressure according to the type and condition of soil specified in Table 2.6.3-1is not exceeded. The presumed allowable bearing capacities for the different types of ground shall enable a preliminary foundation design to be carried out, which can be adjusted up or downwards after further testing, geotechnical investigation and analysis;

(iii) The concrete shall be of a grade with characteristic strength that is in accordance with RS EAS 131-1 at the age of 28 days; and

(iv) The foundation concrete shall be of a thickness not less than its projection from the base of the wall, buttress or pier forming part of a wall, and in no case less than 0.2m.

2.6.3.3.1.8. Where the strip foundation is laid at more than one level, at each change of level, the higher foundation shall extend over and combine with the lower foundation for a distance not less than the thickness of the foundation, and in no case less than 0.3m.

2.6.3.3.1.9. Any floor slab forming a foundation shall be thickened so that the width below the floor slab, or the combined depth of the floor slab and the thickened portion, shall not be less than that required for a continuous strip foundation.

2.6.3.3.1.10. The foundation of every building shall be taken down to such a depth or be so designed and constructed as to safeguard the building against damage by swelling, shrinking or erosion of the subsoil.

2.6.3.3.2. EMPIRICAL RULES FOR FOUNDATIONS

2.6.3.3.2.1. Any foundation shall be constructed in concrete with a compressive strength of not less than 10N/mm^2 using appropriate proportions of cement, sand and coarse aggregate or otherwise suitable.

2.6.3.3.2.2. Any continuous strip foundation shall have a thickness of not less than 0.2m width provided that where the foundation is laid on solid rock, such thickness shall not apply.

2.6.3.3.2.3. The thickness, length and width of the foundation to any sleeper pier or sleeper wall shall be not less than 0.2m, 0.5m, and 0.3m, respectively.

2.6.3.3.3. DESIGN & CONSTRUCTION REQUIREMENTS

2.6.3.3.3.1. The shallow foundation shall be derived from bearing capacity to spread the load to the ground at shallow depth and shall be applicable to isolated footings, combined footings and raft/mats.

2.6.3.3.3.2. The design of foundation concrete structures shall be in accordance with RS 142 and shall comply with the requirements of Part 6 Section 8 of this Code.

2.6.3.3.3.3. Precast concrete foundations shall enclose basements and crawlspaces and to resist lateral earth and hydro pressures and the panels shall be set into place on levelled, compacted crushed stone or cast-in situ continuous footing.

2.6.3.3.3.4. Footings shall be provided under walls, plasters, columns, piers, chimneys etc. bearing on soil or rock, except that footings may be omitted under pier or monolithic concrete walls if safe bearing capacity of the soil or rock is not exceeded.

2.6.3.3.3.5. Where footings are adjacent to sloping ground or where the bottoms of the footings of a structure are at different levels or at levels different from those of the footings of adjoining structures, the depth of the footings shall be such that the difference in footing elevations shall be subject to the following limitations:

(i) When the ground surface slopes downward adjacent to a footing, the sloping surface shall not intersect a frustum of bearing material under the footing having sides which make an angle of 30° with the horizontal for soil and horizontal distance from the lower edge of the footing to the sloping surface shall be at least 600mm for rock and 900mm for soil;

(ii) In the case of footings in granular soil, a line drawn between the lower adjacent edges of adjacent footings shall not have a steeper slope than one vertical to two horizontal; and

(iii) In case of footing of clayey soils a line drawn between the lower adjacent edge of the upper footing and the upper adjacent edge of lower footing shall not have a steeper slope than 45°.

2.6.3.3.4. STRIP FOUNDATIONS

2.6.3.3.4.1. The foundations for the load bearing structure of a single storey building where constructed as strip foundations of plain concrete situated centrally under the walls or piers, shall be constructed such that:

(i) There is no wide variation in the type of subsoil over the loaded area and no weaker type of soil exists below that on which the foundations rest within such a depth as may impair the stability of the structure;

(ii) Constructed for pressures according to the type and condition of the soil specified in Table 2.6.3-2;

(iii) The concrete is composed of cement and well-graded aggregate in the proportion of 50kg of cement to not more than $0.35m^3$ of well-graded aggregate;

(iv) The thickness of the concrete is not less than its projection from the base of the wall or footings, as the case may be, and in no case less than150mm, except that where the foundation bed is of hard rock only sufficient concrete need be used to level the foundation in masonry courses provided that in the case of a single storey domestic building constructed with external walls of 150mm thickness in accordance with this Code, the thickness of the concrete may be reduced to not less than 150mm if the bearing capacity of the subsoil is not less than $75kN/m^2$;

(v) Where the foundations are laid at more than one level, at each change of level the higher foundations extend over and unite with the lower foundations for a distance not less than the thickness of the foundations and in no case less than 300mm; and

(vi) Where there is a pier or buttress forming part of a wall, the foundations project beyond the pier or buttress on all sides at least to the same extent as they project beyond the wall.

(vii) In all cases, the width of foundation shall not be less than the width of the wall.

2.6.3.3.5. SHALLOW FOUNDATION

Shallow foundations shall spread the load to the ground at shallow depth where the capacity of this foundation is derived from bearing.

2.6.3.3.5.1. FOOTING

2.6.3.3.5.1.1. Footings shall be provided under walls, pilasters, columns, piers, chimneys, etc. bearing on soil or rock, except that footings may be omitted under pier or monolithic concrete walls if safe bearing capacity of the soil or rock is not exceeded.

2.6.3.3.5.2. RAFT/MAT

2.6.3.3.5.2.1. A raft foundation may be one of the following types:

(i) Flat plate or concrete slab of uniform thickness usually supporting columns spaced uniformly and resting on soils of low compressibility;

(ii) Flat plates as in (i) but thickened under columns to provide adequate shear and moment resistance;

(iii) Two way slab and beam system supporting largely spaced columns on compressible soil; and

(iv) Cellular raft or rigid frames consisting of slabs and basement walls, usually used for heavy structures.

2.6.3.3.6. DEEP FOUNDATION

2.6.3.3.6.1. Design, construction and specification of a deep foundation shall be done in accordance with the used design material.

2.6.3.3.6.2. Footing shall be designed to keep the maximum imposed load within the safe bearing values of soil and rock. To prevent unequal settlement footing shall be designed to keep the bearing pressure as nearly uniform as practical.

2.6.3.3.6.3. Footings located in fill are subject to the same bearing capacity, settlement, and dynamic ground stability considerations as footings in natural soil. The behaviour of both fill and underlying natural soil shall be considered.

2.6.3.3.6.4. Soil and rock properties defining the strength and compressibility characteristics of foundation materials shall be required for footing design. Foundation stability and settlement analysis for design shall be conducted using soil and rock properties based on.

2.6.3.3.6.5. DRIVEN PILES

2.6.3.3.6.5.1. For driven precast concrete piles, a pile structure capable of being driven into the ground and able to resist handling stresses shall be used for this category of piles.

2.6.3.3.6.5.2. For driven cast-in-situ concrete piles, a pile formed by driving a steel casing or concrete shell in one or more pieces, which may remain in place after driving or withdrawn, with the inside filled with concrete, falls in this category of piles. Sometimes an enlarged base may be formed by driving out a concrete plug.

2.6.3.3.6.5.3. For driven pre-stressed concrete pile, a pile constructed in pre-stressed concrete shall be a casting yard and subsequently driven in the ground when it has attained sufficient strength.

2.6.3.3.6.5.4. For timber piles, a structural timber (see Part 6 Section 10 of this Code) shall be used as piles for temporary structures for directly transmitting the imposed load to soil. When driven timber poles are used to compact and improve the deposit.

2.6.3.3.6.6. BORED PILES/ CAST IN-SITU PILES

2.6.3.3.6.6.1. These piles shall be constructed by concreting bore holes formed by auguring, rotary drilling or percussion drilling with or without using bentonite mud circulation.

2.6.3.3.6.6.2. Excavation or drilling shall be carried out in a manner that will not impair the carrying capacity of the foundations already in place or will not damage adjacent foundations.

2.6.3.3.6.6.3. These types of foundations shall be tested for capacity by load test or for integrity by sonic response or other suitable method.

2.6.3.3.6.6.4. Under-reaming drilled piers shall be constructed in cohesive soils to increase the end bearing.

2.6.3.3.6.7. DRILLED PIER/ DRILLED SHAFTS

2.6.3.3.6.7.1. The drilled pier having a larger diameter more than 600mm shall be constructed by excavating the soil or sinking the foundation.

2.6.3.3.7. FOUNDATION DEPTH REQUIREMENTS

2.6.3.3.7.1. The foundation shall be taken below the likely depth of surface water scour, organic matter and animal/termite activity, in addition to bearing on suitable founding material in line with the engineer's design considerations are required.

2.6.3.3.7.2. Retaining walls for foundations shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift and that they be designed for a safety factor of 1.5 against lateral sliding and overturning.

SECTION 4: FLOORS

2.6.4.1. GENERAL REQUIREMENTS

2.6.4.1.1. A floor of any building shall be designed with adequate strength to support its own weight and all imposed loads on it and shall have appropriate fire resistance rating applicable to its use.

2.6.4.1.2. All floors shall be so framed and secured into the framework and supporting walls to form an integral part of the whole building.

2.6.4.1.3. The floor design shall consider the accessibility and safety of disabled people.

2.6.4.1.4. Any floor supported on ground shall be constructed of impervious units consisting of slabs, bricks, natural stones or other approved material of thickness not less than 40mm. Floor shall be constructed on adequate sub-base.

2.6.4.1.5. Adequate water resistance shall be considered for floors of any laundry, kitchen, shower room, lavatory or room containing a Water Closet pan or urinal.

2.6.4.1.6. If the floor for which sub-regulation 2.6.4.1.4 applies is constructed in concrete, such concrete shall be designed with a minimum characteristic strength not less than 15N/mm^2 at the age of 28 days, the concrete floor slab shall be a minimum of 100mm thickness.

2.6.4.1.7. In every building, the lowest floor in every part of the building shall resist the passage of moisture from the ground.

2.6.4.1.8. The requirement of sub-regulation 2.6.4.1.8 shall be deemed satisfied if a floor, being a solid floor, is itself or its finishes, impervious to moisture or a damp proofing layer of approved type is inserted within the thickness of the floor.

2.6.4.1.9. The provision of adequate under-floor ventilation shall be made for suspended timber floors of any building.

2.6.4.2. FLOOR CONSTRUCTION & STRUCTURAL DESIGN

2.6.4.2.1. Any floor on any building shall comply with the fire requirements contained in the regulations of Part 8 of this Code.

2.6.4.2.2. For floor construction, under floor membrane shall not be less than 500 gauge minimum and shall be laid on a surface which shall not contain any sharp object that may perforate such membrane that shall be turned up around the perimeter and at least for the full thickness of the slab.

2.6.4.2.3. Any joint in such membrane shall be double-lapped by not less than 150mm and shall be effectively sealed.

2.6.4.2.4. Any floor on any building shall comply with the fire requirements contained in the regulations of Part 8 Section 2 of this Code.

2.6.4.2.5. Filling materials under floor shall consist of suitable material and be applied in well compacted layers not more than 150mm in thickness.

2.6.4.2.6. There shall be prescription of adequate dosage of chemicals for termite's protection; such chemicals for anti-termite protection shall be applied to all timber forming part of the structural works. The application shall be evenly spread to all surfaces of the timber.

2.6.4.2.7. For each floor or portion of a commercial or industrial building designed to exceed 2.40kN/m^2 where there is the live loads, such design of live loads shall be clearly posted by the owner in that part of each story in which they apply, with durable signs. It shall be illegal to remove or spoil such notices.

2.6.4.2.8. It shall be illegal to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than that permitted in Part 6 Section 2 of this Code.

2.6.4.2.9. The structural design and analysis for Reinforced Concrete floors shall comply with the requirements of RS 142.

2.6.4.2.10. The design and construction of floors in steel shall include general design requirements, design of tension members, design of compression members, design of members subjected to bending, design of members subjected to combined stresses, design of connections, design of encased members, shall be done in accordance with RS EAS 134.

2.6.4.2.11. All materials used in structural steel floor construction shall conform to Part 7 Section 3 of this Code and all structural steel, rivets, welding consumables, steel castings, bolts and nuts, washers and steel tubes shall be in accordance with relevant parts of RS ISO 4948.

2.6.4.2.12. The specification of steel types to be used particularly in industrial flooring shall comply with the requirements of Part 6 Section 12 of this Code.

2.6.4.2.13. The floor of the water closet constructed of cement concrete shall have at least 100mm thickness and shall be impervious to moisture.

2.6.4.2.14. The classification and specifications of timbers shall be in accordance with Part 7 Section 3 of this Code, and the structural design for floor shall comply with the requirements of this Part 6 Section 10 of this Code.

2.6.4.2.15. The laying of all types of flooring of wood and wood products shall comply with requirements of ISO 17959.

2.6.4.2.16. The installation and use of wood-based panels as primarily a load-bearing surface shall comply with the guidance given in ISO 17959.

2.6.4.2.17. Composite floors shall consist of a concrete topping cast onto metal decking and shall be in accordance with Part 6 Section 14 of this Code.

2.6.4.2.18. The structural design for composite floors shall comply with requirements of Part 6 Section 14 of this Code.

2.6.4.2.19. The design, construction and maintenance of ceramic and any other floor tiling shall comply with the requirements of relevant sections of Part 6 of this Code.

SECTION 5: WALLING & MASONRY

2.6.5.1. MATERIALS

2.6.5.1.1. Any material to be used in wall elevation shall fulfil all the requirements provided in relevant sections of Part 7 of this Code.

2.6.5.1.2. The use of locally produced building materials including Adobe bricks that do not compromise the natural ecosystem and which use the least energy for their production and transport must be emphasized in accordance with the building Code.

2.6.5.1.3. Specifically, the use of adobe bricks is accepted for all buildings in category two as provided in the Ministerial Order categorizing the buildings.

2.6.5.2. WALL DIMENSIONING

2.6.5.2.1. The height of a wall shall be measured in the following manner:

(i) The height of the lowest or only storey shall be measured from the underside of that part of the wall that immediately rests upon the footings, that is the base, to the highest part of the wall;

(ii) The height of any other storey shall be measured from the level of the underside of the floor structure above it or if there is no storey to the highest part of the wall, or in a storey comprising a gable to half the height of the gable;

(iii) The height of a party wall comprising a gable shall be measured from its base to the base of the gable; and

(iv) The height of any other wall comprising a gable shall be measured from its base to its highest part excluding any parapet that does not exceed 1m in height.

2.6.5.2.2. The length of a wall shall be measured from the centres of dividing walls, piers, buttresses or any other members dividing the wall into distinct lengths.

2.6.5.2.3. The thickness of a load-bearing external wall, internal load bearing wall or party wall of any length shall not be less than 200mm, or any thickness which is structurally adequate and approved by the Building Consent Authority, provided that the height of the wall does not exceed 3m.

2.6.5.2.4. Timber framed walls shall have dimensions as specified in Table 2.6.5-1.

Table 2.6.5-1: Permissible Dimensions for Timber-framed Walls

Wall Types	Stud Size (mm)	Stud Spacing (mm)	Maximum Panel Length (m)		Maximum Height* (m)	Maximum Storey Height (m)
			Supported Both Ends	Supported One End		
Structural	100x50	400	4.8	2.4	6.0	4.0
	100x50	600	4.0	2.0	6.0	3.0
	75x50	450	3.8	1.8	6.0	3.0
Non-structural	100x50	600	4.8	3.0	-	4.0
	70x50	600	4.2	2.4	-	3.0

*Maximum height means height to wall plate of highest storey or height to top of gable, if there is a gable

2.6.5.3. STRUCTURAL STRENGTH & STABILITY

2.6.5.3.1. Any wall shall be able to support dead, live, and lateral or any kind of load imposed on it in a safe and sustainable way and shall be capable to transfer such load on supporting foundation.

2.6.5.4. RESISTANCE TO WEATHER CHANGES

2.6.5.4.1. Any external wall of a building, including any parapet wall to the building, shall adequately resist the penetration of rain.

2.6.5.4.2. No wall, pier or column of a building shall permit the passage of moisture from the ground to the inner surface of any storey of the building or to any part of the building.

2.6.5.4.3. The requirements of sub-regulation 2.6.5.4.2 shall be deemed satisfied where any wall of the building in contact with the ground is provided with an approved damp-proofing course complying with sub-regulation 2.6.5.4.5, which in the case of an external wall shall be continued to a height not less than 150mm above the surface of the ground adjoining the wall.

2.6.5.4.4. Other additional barriers to moisture in continuation of the damp-proof course required by paragraph 2.6.5.4.5 of this regulation as may be necessary to ensure that dampness from the ground cannot reach any timber or other material that would be harmfully affected by it or the interior of the walls of any storey of the building, other than a basement used for storage purposes only.

2.6.5.4.5. The designs and specifications of damp-proof courses shall be in accordance with the approved relevant standards.

2.6.5.5. CONNECTION WITH OTHER STRUCTURAL MEMBERS

2.6.5.5.1. Any structure elements like roof truss, rafter or beam supported by a wall, provision shall be made to fix that element to such wall in a secure manner that will ensure that any forces to which the roof may normally be subjected will be transmitted to such wall. The joint between the wall and ceiling shall be a good fit to prevent the spread of fire and smoke.

2.6.5.5.2. Concrete or masonry walls shall be anchored to all floors and roofs which provide later support for the wall or are required to provide stability for the wall. Such anchorage shall be capable of resisting the horizontal forces. Required anchor in masonry walls of hollow units or cavity walls shall enter a reinforced grounded structural element of the wall.

2.6.5.6. FIRE RESISTANT WALLS

Any wall shall be constructed to resist a fire in accordance with Part 8 Section 2 of this Code.

2.6.5.7. WALLS SUPPORTS

2.6.5.7.1. When columns and piers are required to be built as supports to walls, they shall be provided at each end of the wall and at intermediate distances not exceeding 3m centre to centre of the columns or piers in other to respect the strength and stability of the structure and they shall have a height not greater than twelve times of their least lateral dimensions.

2.6.5.8. EXTERNAL WALLS

2.6.5.8.1. The external wall of a building of not more than one storey in height, whose width in the direction of the span of the roof does not exceed 10m, and whose height does not exceed 3m, or a veranda, loggia, garage, greenhouse, tool shed, fuel store, water closet, lavatory, or wash-house which does not exceed 3m in height, and is attached to the house, shall not be less than 100mm in thickness subject to the following conditions:

(i) A wall exceeding 2m in height or length shall be bonded into piers not less than 200mm in horizontal section, or where piers of greater size shall be required to give stability to the wall of such greater size;

(ii) Where any pier is required, the piers shall be provided at each end of the wall and at intermediate distances not exceeding 3m centre to centre of the piers;

(iii) The roof shall be constructed so that the walls are not subjected to any thrust; and no load other than the distributed loading from the roof shall be borne on the wall; and

(iv) Where a roof truss, rafter, beam, or any other member forming part of the roof structure is supported on a wall, provision shall be made to fix the roof structure to the wall in a secure and approved manner, so that any forces to

which the roof is normally subjected shall be transmitted to the wall, and to hold down the roof structure against uplift due to wind forces.

2.6.5.8.2. OPENINGS IN AN EXTERNAL WALL

2.6.5.8.2.1. The distance between any part of an opening or recess made in an external wall and the outer face of an external return wall shall not be less than one and half times the thickness of the wall in which the opening or recess is made unless adequate support at the corner is provided by another approved method.

2.6.5.8.2.2. Adequate means of supporting the superstructure shall be provided over every opening and recess in an external wall or party wall.

2.6.5.8.2.3. The number, size or position of openings or recesses on a wall shall not impair the stability of the wall.

2.6.5.8.3. EXTERNAL WALLS IN DOMESTIC BUILDINGS

2.6.5.8.3.1. If external load bearing walls of either single storey or double storeys domestic buildings to be used only for living accommodation are constructed in accordance with this Code, they will satisfy its requirements.

2.6.5.8.3.2. The thickness of a wall of an outbuilding not communicating directly with the building to which it is appurtenant shall not be less than 100mm if it exceeds 2m in height and 3m in length.

2.6.5.8.3.3. A partition wall shall not be deemed to be a buttressing wall unless there shall be at least a length thereof of not less than 200mm bonded into the outer wall for its full height and is not less than 200mm thick with a tolerance of 2mm.

2.6.5.9. NON-LOAD BEARING WALLS, PARTITIONS & INDIVIDUAL PANELS

2.6.5.9.1. Concrete blocks used in non-load-bearing external panel walls must comply with the strength requirement of this Code. The crushing strength of concrete blocks shall be determined in the manner provided in Part 7 Section 3 of this Code.

2.6.5.9.2. A common non-load-bearing wall, partition or individual panel shall be deemed satisfactory if the size of the wall, partition or individual panel is designed so that its length or height is not greater than the dimensions specified in relevant parts of RS 112.

2.6.5.9.3. Where both the length and the height of a partition wall or individual panel exceeds the specified dimensions, the wall shall be divided into panels by vertical and horizontal supports of adequate strength and rigidity, and the individual panel shall be supported along two vertical opposite ends that shall, in addition, be attached to the main structure by bonding, inserting into a groove, or by other approved methods of fixing.

Table 2.6.5-2: Thickness of Non-loading Bearing Walls

Wall Thickness(mm)	Maximum Wall Height/Length(m)
75	3
100	4.5
125	5
150	6.5
200	8

2.6.5.10. PARTY OR SEPARATING WALLS

2.6.5.10.1. The thickness of a party wall or separating wall built with bricks, concrete blocks, natural stone or any other approved materials, shall comply with the requirements of sub-regulation 2.6.5.2.3; where the external walls of any building are 150mm in thickness, the thickness of the party wall or separating wall shall also be 150mm.

2.6.5.10.2. A wall which is continuous with a boundary, shall be constructed of thickness not less than that for an external wall, also it shall satisfy all requirements for external walls as described in this Code, as well as a degree of fire resistance of not less than the specified period in Part 8 Section 2 of this Code.

2.6.5.11. FOUNDATION WALLS

2.6.5.11.1. Hollow blocks shall be used neither in sub-structure foundation walls nor in the chimney construction but shall be used for very light and non-load bearing walls.

2.6.5.11.2. Foundation walls shall be designed to resist forecast action and to support safely all vertical and lateral loads. The maximum stresses due to combined loads shall be within the values specified for the materials used in the construction. Unless properly reinforced, tensile stresses shall not exceed those permitted in plain masonry.

2.6.5.11.3. The thickness of foundation walls shall exceed that of the wall supported, and the minimum thickness shall be limited for the various materials of construction as herein specified.

2.6.5.11.4. A foundation masonry wall shall not have a thickness thinner that the width of its wall. All foundation masonry shall have 50mm of extra width on both sides compared to the width of its wall.

2.6.5.11.5. The height of any foundation wall which is not designed as a retaining wall derive from design calculations. or where the difference in ground level including backfill exists between the two sides of a foundation wall.

2.6.5.11.6. The difference in ground level as well as backfill existing between two sides of any foundation wall shall not be greater than 1m unless that wall is designed to also act as a retaining wall.

2.6.5.12. CHASES

2.6.5.12.1. Chases walls shall not be constructed as to reduce the required strength, thickness or fire resistance of the wall. The chases shall be designed and constructed as openings. In the case of load bearing structures, chases shall be cut under the supervision of a qualified professional with a valid practicing certificate to ensure quality.

2.6.5.13. BOUNDARY WALLS AND FENCES

2.6.5.13.1. Boundary walls and fences shall be erected in a vertical plane, shall be constructed with approved materials, and shall incorporate sufficient, securely fixed supports to ensure the stability. These structures shall not exceed a height of 2m above the ground.

2.6.5.13.2. When a plot is required to be protected by a boundary wall for a public building, the height of the external walls, if built in brick or block work, shall not exceed three courses. The material to be utilised above this level may be any approved material that does not obstruct the frontage of the building.

2.6.5.14. RENDERING

2.6.5.14.1. Where rendering is required; a rendering not less than 15mm thick shall be applied externally on all un-faced stone, bricks, blocks and slabs used in external walls or another similar treatment may be applied.

2.6.5.14.2. A suitable waterproofing compound shall be necessary, where the permeability of blocks is required in order to satisfy the requirements of this Code.

2.6.5.15. COPING

2.6.5.15.1. All masonry retaining walls other than reinforced concrete walls shall be protected with an approved coping.

2.6.5.15.2. Boundary walls, fences and parapet walls must have a coping designed and installed in such a manner to prevent vertical water penetration**.**

2.6.5.16. MASONRY WALLS DIMENSIONS

2.6.5.16.1. Masonry walls in buildings shall have dimensions complying with Table 2.6.5-3. The provision of this regulation 2.6.5.16.1 shall only apply to clay burnt bricks and cement blocks constructed walls.

Table 2.6.5-3: Permissible Dimensions of Masonry Walls in Buildings

Nominal Wall Thickness (mm)	Use of Wall in a Building	Maximum Storey Height (m)	Maximum Height Ground Floor to Top of External Gable (m)	Maximum Unsupported Length (m)	Minimum Nominal Unit Strength (MPa)	
					Hollow Units	Solid Units
90	Non-structural internal wall in any storey	3	NA	4	7	3.5
	Building to height of 25m	3.3	NA	NP	7	NP
	Other than its own weight	3	NA	4	7	3.5
140	Non-structural internal wall in any storey	3	NA	6	7	3.5
	Building to height of 25m	3	NA	5	7	3.5
	Structural wall in single storey building	3.3	5	6	7	3.5
	Structural wall in double storey building	3	6	6	10.5	7
190	Non-structural internal wall in any storey	3.5	NA	8	7	3.5
	Building to height of 25m	3.3	NA	7	7	3.5
	Structural wall in single storey building	3.5	5.5	7	7	3.5
	Structural wall in double storey building	3.3	8	7	10.5	7
230	Non-structural internal wall in any storey	4	NA	8	7	3.5
	Building to height of 25m	3.3	NA	8	7	3.5

	Structural wall in single storey building	4	6	8	7	3.5
	Structural wall in double storey building	3.3	8	8	10.5	7
	Building to height of 25m	3.3	NA	5	7	3.5
	Structural wall in single storey building	3	4.5	7	7	3.5
	Structural wall in double storey dwelling unit without concrete slab roof	2.8	7.5	7	14	NP
140-50-140 to 140-110-140 cavity wall	External infilling and cladding to framed building to height of 25m	3.3	NA	6	7	3.5
	Structural wall in single storey building	3	5	6	7	3.5
	Structural wall in double storey building	3	8	8	14	7

NOTE: NA means NOT APPLICABLE NP means NOT PERMITTED

2.6.5.17. MORTAR

2.6.5.17.1. The mortar to use in wall elevation shall be in accordance with RS 108.

2.6.5.17.2. The methods of test of mortar for masonry shall be in accordance with RS 211.

2.6.5.18. BONDING

2.6.5.19. Walls constructed in bricks, concrete blocks or natural stone, both load bearing and non-load bearing, shall be bonded with mortar of thickness not greater than 15mm in bedding joints and 10mm in vertical joints, and the mortar shall satisfy the requirements of RS 108.

2.6.5.20. RETAINING WALLS OF MASONRY

2.6.5.20.1. A masonry retaining wall, not being a basement or foundation wall of a building, shall not be erected where the ground, or fill which it retains, is subjected to the imposed loads within a distance equal to the height of the retained material unless the wall is designed by a qualified person.

2.6.5.20.2. The retaining wall intended to support any structure erected at its top shall be well designed in compliance with this Code provided that a wire fence less than 1.5m in height shall not be considered as a structure.

2.6.5.20.3. Walls built to retain or support the lateral pressure of earth or water or other superimposed loads shall be designed and constructed of approved masonry, reinforced concrete, steel sheet piling or other approved materials within the allowable stresses specified in this Code and the subsoil drainage shall be required behind the retaining wall together with sufficient weep outlets in such wall in order to prevent the accumulation of water.

2.6.5.20.4. No surcharge of fill shall be permitted to be placed behind retaining wall within a distance equal to the height of the wall unless designed to withstand such loading by a properly qualified professional

2.6.5.20.5. The horizontal damp-proof course of sheet material shall not be used in any retaining wall.

2.6.5.20.6. According to the site condition, any masonry retaining wall shall be constructed of solid masonry units laid in any acceptable fully-bonded pattern and shall have the limits of height, wall thickness and pier size not exceeding the dimensions given in Table 2.6.5-4.

Table 2.6.5-4: Retaining Walls Dimensions

Normal Wall Thickness (mm)	Maximum Height of Fill to Be Retained (m)	Piers	
		Nominal Dimensions (Projection x Width) (mm)	Maximum Spacing Centre to Centre (mm)
190	0.8	No piers required	
	1.1	300 x 190	2.0
	1.3	400 x 190	2.4
230	0.9	No piers required	
	1.4	360 x 230	2.5
	1.5	480 x 230	2.7
290	1.1	No piers required	
	1.5	300x290	2.7
390	1.4	No piers required	

2.6.5.21. CAVITY WALLS

2.6.5.21.1. Where a cavity is formed in an external masonry wall, it shall have a width ranging between 50mm and 110mm and shall be sealed.

2.6.5.21.2. Any cavity wall shall be with wall ties installed in an even distributed pattern with a rate of 2.5 ties per square meter of the face area of such wall where that cavity wall less than 75mm in width and with a rate of 3 ties per square meter of face area where that cavity is greater than 75mm.

2.6.5.21.3. Where a cavity is formed in an external masonry wall, it shall have a width ranging between 50mm and 110mm and shall be sealed.

2.6.5.21.4. Any cavity wall shall be with wall ties installed in an even distributed pattern with a rate of 2.5 ties per square meter of the face area of such wall where that cavity wall less than 75mm in width and with a rate of 3 ties per square meter of face area where that cavity is greater than 75mm.

2.6.5.21.5. Any cavity wall shall be protected against moisture by directing it away from the inner leaf of the wall.

2.6.5.22. FREE-STANDING WALLS

2.6.5.22.1. Any masonry free-standing wall shall have courses laid in any acceptable fully-bonded pattern and their dimensions (height, thickness and pier size) shall be relevant according to the Table 2.6.5-5.

2.6.5.22.2. No damp-proof courses are required for any free-standing wall; there shall be use of high density bricks with water absorption less than 7% up to 150mm above the ground in the case of moisture encountered from the ground.

2.6.5.22.3. Any cavities in piers in a wall built of hollow units shall be filled with concrete.

Table 2.6.5-5: Free Standing Walls Dimensions

Nominal Wall Thickness (mm)	Maximum Height of Wall Above Finished Ground (m)		Piers	
	Without Piers	With Piers	Nominal Dimensions (Length X Width) (mm)	Maximum Spacing (Centre to Centre) (m)
90	0.8	1.2	200x290	1.8
110	1.0	1.4	240x230	1.8
140	1.3	1.6	300x290	2
190	1.5	2	400x290	2.5
230	1.8	2.3	480x350	3.5
290	2.2	2.6	400x290	4.5

2.6.5.23. MASONRY CHIMNEYS

2.6.5.23.1. The chimney shall have wall of masonry units, bricks, stones, listed masonry chimney units, reinforced concrete or equivalent solid thickness of hollow masonry.

SECTION 6: PROTECTION AGAINST FALLING

2.6.6.1. APPLICATION

This section shall apply to every building or structures which present the risk of falling down. It provides the requirements for protection of people from falling from building and design requirements for structures such as parapets, balustrades, vehicle barriers and other structures that serve for protection.

2.6.6.2. BALUSTRADES AND PARAPETS

2.6.6.2.1. The thickness of a parapet to an external wall shall not be less than 150mm or the thickness of the wall on which it is carried, whichever is lesser and its height shall not exceed six times the thickness.

2.6.6.2.2. Parapet walls shall have a height not less than 1m above the point where the roof surface and the wall intercept, they must be fire resistant same as the wall upon which they are erected with non-combustible coping materials also designed and installed in a manner to prevent vertical water penetration.

2.6.6.2.3. The balustrade walls shall fulfil all the requirements elaborated in this Code.

2.6.6.2.4. Where a solid balustrade wall is provided in structure, it shall be tied to a reinforced concrete or block columns or bonded into return walls or reinforced brick piers.

2.6.6.2.5. When it is necessary to provide solid masonry balustrade wall with expansion joints spaced less than 8 m apart and that wall is supported by reinforced concrete or brick columns or reinforced brick piers, those expansion joints shall be formed in such columns or piers.

2.6.6.2.6. The brick balustrade wall shall be reinforced with adequate reinforcements in its bed joints.

2.6.6.2.7. The balustrade and parapets shall be designed to resist the appropriate loads shown in Table 2.6.6-1.

2.6.6.2.8. Those forces are considered as forces acting horizontally at a height of 1.1m above the finalised level of the access platform.

Table 2.6.6-1: Appropriate Loads Acting on the Parapets and Balustrades

Occupancy	Use	Horizontal Uniformly Distributed Loads (kN/m^2)	Uniformly Distributed Loads Applied to the Infill (kN/m^2)	Point Loads to Part of the Infill (kN)
Other occupancy classes	(1) Light access stairs, gangways and like not more than 600mm wide.	0.22	Not applicable	Not applicable
	(2) Staircases, balconies, ramps, landings or floors within, or serving exclusively one dwelling.	0.36	0.5	0.25
	(3) Staircases in residential buildings not covered by (1) or (2)	0.36	1	0.50
	(4) Staircases, landings ,floors, balconies, flat roofs with access, walkways and edges of sunken areas not covered by (1) to (3) or(6) to (8)	0.74	1	0.50
Public assembly classes	(5) Balconies or parts of balconies, stands, etc. having fixed seating within 530mm of the barrier.	1.5	1.5	1.5
	(6) Staircases, ramps, landings or floors in theatres, cinemas, concert halls, assembly halls, stadia, etc.	3	1.5	1.5
	(7) Footways or pavements, within building cartilage, adjacent to access roads, basement or sunken areas.	1	1	1
	(8) Pavements or areas not less than 3m wide adjacent to sunken	3	1.5	1.5

2.6.6.3. VEHICLE BARRIERS

2.6.6.3.1. Any wall, parapet or balustrade serving as a vehicle barrier shall be able of resisting to forces set out in Part 6 of this Code.

2.6.6.3.2. The horizontal force uniformly distributed on a length of 1.5m required to sustain the impact load of a vehicle shall be obtained by the following formula:

$$\mathbf{F = \frac{0.5 * M * V^2}{c + b}}$$

Where:

M is the gross mass of the vehicle (in kg);

V is the velocity of the vehicle (in m/s) normal to the barrier;

c is the deformation of the vehicle (in mm);

b is the deflection of the barrier (in mm)

2.6.6.3.3. Where the car park has been designed on the basis that the mass of the vehicles using it will not exceed 2,500kg, the following values are used to determine the force F:

(i) M = 1,500kg (the mass of 1,500kg is taken as more representative of the vehicle population than the extreme value of 2,500kg);

(ii) V = 4.5m/s; and

(iii) c = 100mm unless better evidence is available.

2.6.6.3.4. For a rigid barrier, for 'which shall be taken as zero, the force F appropriate to vehicles up to 2,500kg gross mass shall be taken as 150kN.

2.6.6.3.5. Where the car park has been designed for vehicles whose gross mass exceeds 2,500kg the following values are used to determine the force F:

(i) M = is the actual mass of the vehicle for which the car park is designed (in kg);

(ii) V = 4.5 m/s; and

(iii) c = 100mm unless better evidence is available.

2.6.6.3.6. The force F determined above shall be considered to act at bumper height. In the case of car parks intended for motor cars whose gross mass does not exceed 2,500kg this height may be taken as 375mm above the floor level.

2.6.6.3.7. Barriers to access ramps of car parks have to withstand one half of the force F determined above acting at a height of 600mm above the ramp.

SECTION 7: ROOFING STRUCTURES & RE-ROOFING

2.6.7.1. ROOFING STRUCTURES

2.6.7.1.1. GENERAL REQUIREMENTS FOR ROOFS

2.6.7.1.1.1. The roof of a building shall be designed and constructed so as to sustain dead and imposed loads, wind or other forces to which it may be subjected.

2.6.7.1.1.2. The roof of any building shall be so constructed that it will be durable, fire resistant, and waterproof. It shall not allow the accumulation of any rainwater upon its surface and shall be well insulated. It shall be thermal insulator and shall provide adequate insulation against sound.

2.6.7.1.1.3. The roof of a building shall be designed and constructed so as part of a roof and ceiling assembly provide adequate height in any room immediately below such assembly.

2.6.7.1.1.4. For the design of roofs, the additional loads that apply on it shall be in accordance with sub-regulations 2.6.2.2.5 through 2.6.2.2.7 of this code.

2.6.7.1.2. REGULATIONS FOR THE CONSTRUCTION OF ROOFS

2.6.7.1.2.1. The roof structure of a building shall be deemed satisfactory if it is designed and constructed in accordance with Part 6 Section 7 of this Code.

2.6.7.1.2.2. Where any roof is to be supported on the walls of any building, such roof shall be constructed in accordance with sub-regulations 2.6.7.1.3 and 2.6.7.1.7 of this Code.

2.6.7.1.3. FIRE RESISTANCE & COMBUSTIBILITY

2.6.7.1.3.1. In every building, other than a building that sub-regulation 2.6.7.1.3.2 applies to, the roof shall be covered, or the building shall be isolated from other buildings so as to afford adequate protection against the spread of fire into the building or to an adjoining property.

2.6.7.1.3.2. Where a building exceeds 1000m3 in capacity or forms a block of more than two dwelling units, the roof shall be covered with material capable of affording adequate protection against the spread of fire into the building or adjoining property, and may be constructed as a single block.

2.6.7.1.3.3. The roof shall be deemed to satisfy the requirements of sub-regulations 2.6.7.1.3.1 and 2.6.7.1.3.2 if it is covered with: tiles or slabs of burnt clay; cement, metal or galvanized steel sheets; tiles of sisal-cement; or any other approved roofing materials, which are capable of affording adequate protection against the spread of fire.

2.6.7.1.3.4. The roof assembly in any building shall have a fire resistance rating of not less than 30minutes and where the roof assembly exceeds 10m in height, it shall be constructed with non-combustible materials.

2.6.7.1.3.5. In the case of any building exceeding 10minheight or that has a roof area exceeding of 500m2, the roof covering material shall be constructed with reinforced concrete or other approved non-combustible materials.

2.6.7.1.3.6. A suspended ceiling and the supporting members of a building shall be of non-combustible materials.

2.6.7.1.3.7. In addition, fire-retardant treated wood roof coverings shall be tested in accordance with ISO 1182.

2.6.7.1.4. WATERPROOFING

2.6.7.1.4.1. The roof of a building shall be durable, weather-proof, and in the case of a roof with a ceiling, the latter shall be provided with a door or scuttle to allow access into the roof space.

2.6.7.1.4.2. The requirements of sub-regulation 2.6.7.1.4.1, as it relates to weather-proof roofs, shall be deemed satisfied if the roof is designed and constructed in accordance with the recommendations in Table 2.6.7-1.

2.6.7.1.4.3. A roof of any building and of any profile, or any other surface susceptible to rainfall shall be constructed to drain effectually to suitable gutters to carry water away from the building.

Table 2.6.7-1 Minimum Roof Slope

Roof Covering	Roof Structure	Roof Slope
Bitumen based/other approved Roofing Products	Concrete slabs	1%
Cement/Clay/Metal Tiles	Concrete Slabs	10%
Cement/Clay/Metal Tiles	Structural Steel/Timber Trusses	25%
Galvanized Steel/Other Approved Sheets	Structural Steel/Timber Trusses	15%
Long Span/Special Profiled Metal sheets	Structural Steel/Timber Trusses	5%

2.6.7.1.5. FIXING & JOINTING GUTTERS & DOWNPIPES

2.6.7.1.5.1. The fixing and jointing gutters and downpipes shall be in accordance with the requirements of Part 11 Section 10 of this code.

2.6.7.1.5.2. Rainwater pipes, gutters and down pipes made of galvanized iron, mild steel, concrete or cast iron shall meet the performance requirements of standards ASTM C76M - 14. They shall also be approved by the Building Consent Authority, and shall be coated or lined with a durable material.

2.6.7.1.6. DESIGN & SETTING UP THE STRUCTURAL ROOF COMPONENTS

2.6.7.1.6.1. The provisions of this section shall be deemed to have been satisfied in terms of the roof structure design where the spacing of roof trusses is in accordance with this Code.

2.6.7.1.6.2. The roof structure can be in timber, wood logs coated with anti-termites product or metal painted with rust proofing.

2.6.7.1.6.3. Construction of roofs shall ensure adequate structural stability. All members shall be accurately located. Purlins and binders shall be built in, where necessary.

2.6.7.1.6.4. Where a roof truss, rafter, beam, or any other member forming part of the roof structure is supported on a wall, provision shall be made to fix the roof structure to the wall in a secure and approved manner, so that any forces to which the roof is normally subjected shall be transmitted to the wall, and to hold down the roof structure against uplift due to wind forces.

2.6.7.1.7. TIMBER ROOF REGULATIONS

2.6.7.1.7.1. All timber for structural use shall comply with the requirements of Part 7 Section 3 of this Code and shall be well seasoned and free from any vermin.

2.6.7.1.7.2. Timber for structural roof components shall be treated against infestation to the approval of the Building Consent Authority. They shall be pre-treated with preservative where specified by the designer.

2.6.7.1.7.3. Timber for external feature work shall be free from waney edges, large knots and resinous pockets, splits and other unsightly defects.

2.6.7.1.7.4. All timber for structural use shall have a sufficient quality and strength complying with the requirements of Part 7 Section 3 to support the imposed loads.

2.6.7.1.7.5. Timber roofs shall be designed in such a manner that they shall not impose any thrust on walls, piers or other means of support unless adequate provision has been made in the design and construction of such wall, pier or other means of support to take all the imposed outward thrust due to vertical and horizontal loads.

2.6.7.1.7.6. Timber purlins shall be designed in accordance with the applied loading. They shall have nominal dimensions not less than 75mm deep by 50mm wide and shall be spaced at centre-to-centre distances not exceeding 1.2m, or as prescribed in the approved standards.

2.6.7.1.7.7. Timber roof truss, rafter, beam or wall plate shall be safely fastened down and connected to their means of support by properly built-in or cast-in galvanized steel strap or galvanized steel wires or bolts or other approved means to the satisfaction of the Building Consent Authority.

2.6.7.1.7.8. Timber structural members shall comply with these requirements:

(i) Timber roof trusses and other roof framing shall have all joints accurately cut, securely made with approved means and so fitted that the component parts are drawn tightly together;
(ii) Where timber is jointed in its length, it shall be by means of approved tensile or compressive joint;
(iii) Joints in adjacent truss members, purlins and rafters shall be staggered;
(iv) Any trussed roof shall be provided with approved bracing to prevent buckling of rafters and tie; and
(v) No member of any truss shall have a length greater than sixty times its least lateral dimensions.

2.6.7.1.8. STRAPPING

2.6.7.1.8.1. The joints of wooden roof trusses must be nailed together and tied with metal straps and other types of connections to provide flexibility so as to prevent collapse under the force of nature.

2.6.7.1.8.2. Straps shall be ordered to the correct length and with the correct number of bends and/or twists required by the design.

2.6.7.1.8.3. Straps shall be used, where necessary, to restrain gable and separating walls and hold down the roof against wind uplift. Restraint straps, or a restraining form of gable ladder, are required to provide stability to walls. They shall be installed as shown in the design and at not more than 2m centres for buildings up to three storeys. Higher buildings straps shall be spaced at not more than 1.25m centres.

2.6.7.1.9. TRUSSED RAFTERS

2.6.7.1.9.1. Trussed rafters shall be protected from damage before and during construction.

2.6.7.1.9.2. Trusses shall be protected against weather to prevent corrosion of truss plates and deterioration of the timber. Ventilation shall also be provided.

2.6.7.1.9.3. Trussed rafters shall be supported only at the junction between the ceiling tie and rafter, unless specifically designed.

2.6.7.1.9.4. Trussed rafters shall be braced to prevent distortion. The roof shall be braced using at least 100mm x 25mm timber. All bracing shall be twice nailed with 3.35mm x 65mm long galvanized round wire nails to every trussed rafter it crosses and to the wall plate.

2.6.7.1.10. JOINTING OF MEMBERS

2.6.7.1.10.1. All joints shall be cut accurately to fit tightly. When they are nailed, care shall be taken not to split members. The nails shall meet the performance requirements of ISO 16670.

2.6.7.1.11. THERMAL INSULATION

2.6.7.1.11.1. Thermal insulation and ventilation of roofs shall prevent the adverse effects of condensation. To avoid condensation that can be formed in the roof space the following shall be ensured:

(i) Ventilation of the roof shall be provided in accordance with the design;
(ii) Insulation shall not block any ventilation paths; and
(iii) Insulation shall be laid over the whole loft area, including the wall plate;

2.6.7.1.12. FLASHING

2.6.7.1.12.1. Flashing shall be used where it is deemed necessary by the Building Consent Authority or around any projection through a roof covering.

2.6.7.1.12.2. Flashing shall be of non-ferrous metal and of the same material to avoid electrolytic action.

2.6.7.1.12.3. Combining different materials can produce a moderately priced flashing with good properties. Some of the most common flashing combinations are sheet metals coated with a flexible compound.

2.6.7.1.12.4. There shall be no gaps in the insulation.

2.6.7.1.13. FLAT & PITCHED ROOFS

2.6.7.1.13.1. There shall be provision of impervious surface where a nominally flat roof of boarded or concrete construction is used and it shall be laid to a fall of minimum slope shown in table 2.6.7.1.

2.6.7.1.13.2. here a parapet walabuts a covered flat roof the edges of the water-proofing material shall be turned up underneath corrosion proof metal cover flashing which is tucked into the horizontal joint of the brickwork at least two courses above the roof level.

2.6.7.1.13.3. When the flat roof is built for pedestrian and vehicular traffic purposes, any waterproofing membrane applied to it shall be protected against damages.

2.6.7.1.13.4. Where a pitched roof abuts the wall at an angle, a stepped cavity tray linked to a stepped flashing shall be used. Stepped flashings shall be cut from a strip at least 150mm wide.

2.6.7.1.13.5. A hipped roof is recommended to protect walls from rain water penetration and for wind resistance. A roof ease of a minimum 35cm is recommended.

2.6.7.1.13.6. The pitched roof with two pitches and more shall have a slope which is able to resist winding loads. The monopitched roof shall have a slope which is able to resist winding loads.

2.6.7.2. RE-ROOFING

2.6.7.2.1. All works of re-roofing shall be erected with the permission of the Building Consent Authority.

2.6.7.2.2. During installation of the system, the structural roof components shall be capable to support all kind of loads system of the roof-covering, material and equipment.

2.6.7.2.3. Suitable re-roof coverings shall be selected, tested and used in compliance with Part 7 Section 3 of this code.

2.6.7.2.4. Before installing the new roof coverings, all existing layers of roof coverings shall be removed, where:

(i) The existing roof or roof covering has deteriorated or is not adequate as a base for additional roofing;
(ii) The existing roof coverings are Asbestos cement sheets; and
(iii) The existing roof has two or more applications of any type of roof covering.

Asbestos shall be removed by a qualified professional.

2.6.7.2.5. During the reinstallation, existing slate, clay or cement tile shall be permitted for reinstallation. Otherwise, if they are damaged, cracked or broken, they shall not be reinstalled.

2.6.7.2.6. The existing structures like vent flashing, metal edgings, drain outlets, collars and metal counter flashings shall not be reinstalled where rusted, damaged or deteriorated.

SECTION 8: CONCRETE

2.6.8.1. APPLICATIONS & PROVISIONS

This section covers the provisions for concrete quality control, design and construction of concrete used in structures; it provides materials requirements for plain concrete, reinforced and pre-stressed concrete and also their testing methods.

2.6.8.2. GENERAL REQUIREMENTS

2.6.8.2.1. Prior to the execution of the structural work, all concrete categories shall be approved by the Building Consent Authority in order to check the durability and workability of that concrete and ensure its safety.

2.6.8.2.2. The concrete shall be transported and deposited without segregation and shall be poured in its place before its initial setting. The placement and compaction shall be done by a vibrator machine and other machines which are not harmful to the structures.

2.6.8.2.3. The specification of constituent materials, production of concrete and compliance of concrete shall conform to RS EAS 417-2 and the constituent materials forming the concrete shall be adequately mixed by mechanical means or any other approved method to ensure uniform distribution of materials, in proportions designed so as to produce the concrete strength and grade specified for the design, having a water to cement ratio not exceeding 0.6 and without water being added after mixing has been completed.

2.6.8.2.4. Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete or reinforcement. Water that is suitable for mixing concrete shall be in conformity with ISO 12439.

2.6.8.2.5. Admixtures to be used in concrete shall be approved by a qualified person in charge of carrying out structural works and shall be capable of maintaining same composition and performance in concrete products.

2.6.8.2.6. Cement materials and aggregates shall be stored in such manner as to prevent deterioration or intrusion of foreign matter. Any deteriorated material or contaminated shall not be used for concrete.

2.6.8.2.7. During pre-stressing operations, extreme cautions shall be taken including the use of stressing equipment and maintenance of such equipment shall be taken into consideration.

2.6.8.2.8. The pre-stressing equipment such as jacks shall be periodically examined to avoid pre-stressing operation fail and care shall be taken so that no one stands in line with tensioning elements during tensioning operations.

2.6.8.2.9. All necessary precautions such as barriers and signs shall be put in place to prevent workmen from working behind the pre-stressing equipment when the stressing operation is in progress.

2.6.8.2.10. The qualified person shall determine the positions of construction joints, when necessary, before concreting commences. When placing concrete at construction joints, the concrete shall be brought up to, for its full width and thickness, a vertical stop-board and on, no concrete shall be permitted to flow or to find its natural slope.

2.6.8.2.11. On resumption of concreting adjacent to a hardened concrete surface, the surface shall be roughened, swept clean, thoroughly wetted, and covered with brushed grout of the same grade as the concrete, or with freshly mixed mortar composed of one part cement and three parts sand. Alternatively, the surface shall be roughened, swept clean, and be painted with an approved mechanical interlock with the roughened aggregates.

2.6.8.2.12. Where a service duct or conduit is incorporated in a member, it shall be fixed in position after the formwork has been erected and in a way that reinforcement is not displaced or the structural adequacy of the member impaired.

2.6.8.2.13. Defects such as fractures, honeycombing or gaps in concrete shall not be plastered over and any remedial works shall be ordered and supervised by a qualified person.

2.6.8.3. DESIGN REQUIREMENTS

2.6.8.3.1. PLAIN CONCRETE

2.6.8.3.1.1. For large project using concrete, concrete shall be mixed in a mechanical mixer. The mixers shall be fitted with water metering devices. The mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency.

2.6.8.3.1.2. The determination of strength, chemical analysis, setting time and soundness, fineness and preparation methods of the cements to use in concrete production shall be done in accordance with relevant parts of RS EAS 148.

2.6.8.3.1.3. The composition, specification and conformity criteria for common cements shall be specified in accordance with RS EAS 18-1.

2.6.8.3.1.4. The specification of aggregates from natural source for use in concrete shall conform to RS EAS 180.

2.6.8.3.1.5. The quality control for sand to be used in concrete shall be selected in accordance with RS 107.

2.6.8.3.1.6. All suitable properties of aggregates to be used in concrete shall be tested in accordance with relevant parts of RS 96.

2.6.8.3.1.7. The concrete quality shall conform to RS EAS 131-1**.** The strength and hardened properties other than strength shall be tested respectively in accordance with RS ISO 1920-4 and RS ISO 1920-5.

2.6.8.3.1.8. The concrete in any structural member shall be properly cured by constant surface wetting for a period of not less than seven days while protecting the surface against rapid drying by covering with hessian or other approved materials or curing agents.

2.6.8.3.1.9. Design of concrete structure for retaining aqueous liquid shall be in accordance to RS 142.

2.6.8.3.1.10. The concrete shall be of a grade with characteristic strength that complies with RS 108 at the age of 28 days.

2.6.8.3.2. REINFORCED CONCRETE

2.6.8.3.2.1. The high strength deformed steel bars shall not be re-bent or straightened without the approval of a qualified person in charge. Bar bending schedules shall be prepared for all reinforcement work.

2.6.8.3.2.2. All reinforcement shall be placed and maintained in the position shown in the drawings by providing proper cover blocks, spacers, supporting bars.

2.6.8.3.2.3. Crossing bars shall not be tack-welded for assembly of reinforcement unless permitted by a qualified person in charge.

2.6.8.3.2.4. Steel materials to be used in reinforced concrete shall conform to the relevant parts of RS ISO 6935.

2.6.8.3.2.5. Steel fabric materials for concrete reinforcement shall conform to the specifications provided in RS ISO 6935.

2.6.8.3.2.6. All reinforcement shall be placed and maintained in positions shown on the approved plans by the use of metal cradles, chairs, concrete briquettes, or other approved methods.

2.6.8.3.2.7. The structural design of concrete and all works concerning reinforcement concrete cover shall comply with the specification provided in RS 142.

2.6.8.3.3. PRESTRESSED CONCRETE

2.6.8.3.3.1. The design and structural use requirements of pre-stressed concrete poles, workmanship, inspection, testing, limit state method shall be in accordance with ASTM C935-13.

2.6.8.3.3.2. Design of pre-stressed members shall be based on strength and on behaviour of the whole structure at all load stages that will bear during the life time of the structure.

2.6.8.3.3.3. All specification for pre-stressed concrete pipes and ancillary concrete products shall comply with RS EAS 426-4.

2.6.8.3.3.4. The buckling possibility between the points where concrete member are connected to pre-stressed concrete member shall be taken into consideration and provisions for effects on adjoining construction of elastic and plastic deformations, deflections, changes in length, and rotations due to pre stressing shall be taken into consideration.

2.6.8.3.3.5. Steel materials to be used in reinforcement and pre-stressing concrete shall be tested in accordance with relevant parts of RS ISO 15630.

2.6.8.3.3.6. Reinforced pre-stressed concrete structure for water and other aqueous liquid storage shall be designed in accordance with ASTM C935-13.

2.6.8.3.3.7. Pre-stressed steel materials that are to be used for pre-stressed concrete shall conform to the specifications provided in relevant parts of RS ISO 6934.

2.6.8.3.4. BEAMS

2.6.8.3.4.1. The effective depth of a reinforced concrete beam shall be taken as distance between the centroid of the area of tension reinforcement and the maximum compression fibre, excluding the thickness of finishing material not placed monolithically with the member and the thickness of any concrete provided to allow for cover.

2.6.8.3.4.2. The beam shall be designed and constructed in the way that the deflection of such beam shall not adversely affect the appearance or efficiency of the structure or finishes or partitions.

2.6.8.3.4.3. The allowable deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members shall not normally exceed span length over 250; brittle finishes are 1/500 and cantilevers are 1/125.

2.6.8.3.4.4. The beams shall have an adequate fire rating as required in Part 8 Section 2 of this Code.

2.6.8.3.5. COLUMNS

2.6.8.3.5.1. The columns shall be well designed and constructed so that they will be able to transmit loads up to foundations.

2.6.8.3.5.2. The columns shall be designed and constructed in the manner which will not cause the impairment of a structure due to buckling and twisting.

2.6.8.3.5.3. The cross-sectional area of longitudinal reinforcement shall be greater than 0.8% and shall not be more than 6% of the gross cross-sectional area of the concrete column.

2.6.8.3.5.4. The number of longitudinal bars provided in a column shall be less than four in rectangular columns and six in circular columns with a diameter not less than 12mm.

2.6.8.3.5.5. The spacing between stirrups along the periphery of a column shall not be greater than 30cm.

2.6.8.3.5.6. The columns shall be sufficiently fire resistant in accordance with Part 8 Section 2 of this Code.

2.6.8.3.6. UNDERWATER CONCRETING

2.6.8.3.6.1. When it is necessary to deposit concrete under water, the methods, equipment, materials and proportions of the mix to be used shall be submitted to and approved by the qualified person in charge before the work is started.

2.6.8.3.6.2. The water-cement ratio shall not exceed 0.6 and may need to be smaller, depending on the grade of concrete or the type of chemical attack. For aggregates of 40mm maximum particle size, the cement content shall be at least 350kg/m^3 of concrete.

2.6.8.3.6.3. Concrete shall be deposited continuously until it is brought to the required height. While depositing, the top surface shall be kept as nearly level as possible and the formation of seams avoided.

SECTION 9: PREFABRICATED CONCRETE

2.6.9.1. GENERAL REQUIREMENTS

2.6.9.1.1. The prefabricated concrete units to use in building construction shall be durable, simple to install & dismantle and can withstand strong gales and rains.

2.6.9.1.2. Every unit of prefabricated concrete shall meet the requirement of Part 6 Section 9 of this Code depending on selected materials.

2.6.9.1.3. For the design and construction of concrete structures made up of prefabricated structural units mixed with cast in-situ concrete shall be accordance with Part 6 Section 9 of this Code and relevant standards.

2.6.9.1.4. The design and construction of floors and roofs using various precast units large panel prefabricates shall be in accordance with ISO 2848and shall also comply with the requirement of Part 6 of this Code.

2.6.9.2. DESIGN CONSIDERATIONS

2.6.9.2.1. The precast structure shall be analysed as a monolithic one and the joints in them designed to take the forces of an equivalent discrete system.

2.6.9.2.2. The prefabricated units shall be suitably designed to resist horizontal loading by having appropriate moment and shear resisting joints or placing shear walls in two directions at right angles or otherwise.

2.6.9.2.3. The individual components shall be designed, taking into consideration the appropriate end conditions and loads at various stages of construction. The components of the concrete structure shall be designed in accordance with this code for loads, forces and effects.

2.6.9.2.4. Every prefabricated concrete structure shall be capable of safely sustaining abnormal conditions of loading and remaining stable after the removal of primary structural members.

2.6.9.2.5. Transport of prefabricated elements shall be carried out with extreme care to avoid any distress and jerk in elements as it is to be placed in final position and suitable precaution shall be taken against overstress or damage, by the provision of suitable packing at agreed points of support.

2.6.9.2.6. Prefabricated concrete elements from solid section shall be adequately protected. Packing of elements shall disfigure or otherwise permanently cause mark on units or members.

2.6.9.3. DESIGN OF PREFABRICATED CONCRETE STRUCTURES

2.6.9.3.1. The method and duration of curing shall be such that the concrete will have satisfactory durability and strength, and that the precast unit will not distort and will not cause undue cracking due to shrinkage.

2.6.9.3.2. The prefabricated concrete structures such as beams, column, wall, floors, staircases, and roof slabs shall be designed under the specification of with RS 142and RS EAS 417-2.

2.6.9.3.3. The design and construction of precast reinforced and pre-stressed concrete triangulated trusses shall also be in accordance with RS 142.

2.6.9.3.4. The specification for precast concrete paving blocks to use in mixed/composite construction shall comply with the provisions of RS EAS 179.

2.6.9.3.5. Precast reinforced concrete box culvert shall conform to the specification provided in RS 62 and also with RS 265.

2.6.9.3.6. Precast concrete pipes and ancillary concrete products for road gullies and gully cover slabs shall be in accordance to RS EAS 426-7.

2.6.9.3.7. All specifications for precast concrete paving block shall be designed in accordance to RS EAS 179. Precast concrete poles for telephone, power and lighting purposes shall be in conformity with RS EAS 489.

SECTION 10: DESIGN OF TIMBER STRUCTURES

2.6.10.1. MATERIALS & GENERAL REQUIREMENTS

2.6.10.1.1. Structural work in timber shall be deemed sufficient for the purpose sustaining and transmitting the dead load, imposed loads and the horizontal or inclined forces above the foundations in load-bearing structures of a building where the design and construction are based upon the recommendations in this Code.

2.6.10.1.2. The methods of design of structural timber elements shall be based on analytical and engineering principles, or reliable test data, or both, that demonstrate the safety and serviceability of the resulting structure.

2.6.10.1.3. Timber species shall be identified in accordance with the general characteristics like durability and treatability of the species. The timber used in construction of building shall be specified and tested in accordance with Section 3 of Part 7.

2.6.10.1.4. The maximum moisture content for structural timber shall be from 12 to 19% depending on the region and shall in accordance with RS ISO 4470

2.6.10.1.5. All materials used in structural design with timber elements such as nails, joints shall comply with the requirements of Part 7 Section 3of this Code.

2.6.10.1.6. The store of timber shall not exceed 9m in height and not be formed so as to provide any room or other space to be used for habitation or any other purpose except access or ventilation.

2.6.10.1. PERMISSIBLE STRESSES

2.6.10.1.1. The design of structural elements or systems constructed partially or wholly of timber products shall take into consideration the allowable stress design, resistance factor design and conventional light-frame construction and shall also be in accordance with Part 6 Section 2 of this Code to meet the following parameters:

(i) Ultimate stress in compression in accordance with RS EAS 279;

(ii) Ultimate tensile stress parallel to grain in accordance with RS EAS 280; and

(iii) Ultimate tensile stress perpendicular to grain in accordance with RS EAS 281.

2.6.10.2. DESIGN CONSIDERATIONS

2.6.10.2.1. In the structural design of timber elements, the loading calculations shall conform to those given in Part 6 Section 2 of this Code.

2.6.10.2.2. The combination and location of loads shall be considered for design. Wind and seismic forces shall not be considered to act simultaneously.

2.6.10.2.3. The structural members which are flexural shall be investigated for:

(i) Bending strength;
(ii) Maximum horizontal and vertical shear;
(iii) Stress at the bearings; and
(iv) Deflection.

2.6.10.2.4. The minimum width of the beam or any flexural member shall not be less than 50mm or 1/50 of the span, whichever is greater unless additional restraint is provided in accordance with clause 2.6.10.3.6.

2.6.10.2.5. The depth of beam or any flexural member shall not be taken more than three times of its width without lateral stiffening unless additional restraint is provided in accordance with clause 2.6.10.3.6.

2.6.10.2.6. Every flexural member having a depth exceeding three times its width or a span exceeding 50times its width or both shall be laterally restrained from twisting or buckling and the distance between such restraints shall not exceed 50times its width.

2.6.10.2.7. The permissible load on a column of circular cross-section shall not exceed that permitted for an equivalent square column of the same cross-sectional.

2.6.10.3. COMMON STEEL WIRE NAIL JOINTS

2.6.10.3.1. The dimension of an individual piece of timber shall be within the range given below:

(i) The minimum thickness of the main members in mono-chord construction shall be 30mm;

(ii) The minimum thickness of an individual piece of members in split-chord construction shall be 20mm for web members and 25mm for chord members; and

(iii) The space between two adjacent pieces of timber shall be restricted to a maximum of 3times the thickness of the individual piece of timber of the chord member. In case of web members, it may be greater for joining facilities.

2.6.10.3.2. Generally, one lengthening joint shall be permitted between the two panel points of the members and no lengthening joint shall preferably be located at a panel point.

2.6.10.3.3. The diameter of nail shall be within the limits of one-eleventh to one-sixth of the least thickness of members being connected and nails shall be diamond pointed.

2.6.10.3.4. Galvanized wire nails shall be used where the nails are exposed to be saline conditions or where timber is treated with copper-based preservatives.

2.6.10.3.5. Edge distances and spacing of nails in a nailed joint shall be well arranged in order to avoid undue splitting of the wood.; otherwise a reduction factor shall be applied based on the number of bolts used in a row parallel to the grain of the timber.

2.6.10.3.6. For a rigid joint, a minimum of 2nails for nodal joints and 4nails for lengthening joint shall be driven and two nails in a horizontal row are better than using the same number of nails in a vertical row.

2.6.10.4. NAIL LAMINATED TIMBER BEAMS

2.6.10.4.1. The minimum thickness of the nail laminated timber beam shall be 20mm and the maximum depth and length of planks of nailed laminated timber beam shall be limited to 0.25m and 2m, respectively.

2.6.10.4.2. Loading on Nail laminated beams shall be in accordance with Part 6 Section 2 of this Code.

2.6.10.4.3. The arrangement of nails in order to get the minimum number of nails and the interval between each one shall be planned and calculated by considering the horizontal shear and as well as the position the planks.

2.6.10.4.4. Shear shall be calculated at various points of the beam and the number of nails required shall be accommodated within the distance equal to the depth of the beam, with a minimum of 4 nails in a row at a standard spacing.

2.6.10.4.5. For nailed laminated beam, the minimum depth of 100mm for 3.55mm and 4mm diameter nails; and 125mm for 5mm diameter nails shall be provided.

2.6.10.5. BOLTED CONSTRUCTION JOINTS

2.6.10.5.1. The design of bolted construction joints shall mainly be influenced by the species, size of bolts, moisture conditions and the inclination of loadings to the grains.

2.6.10.5.2. Bolted timber construction shall be designed using accepted engineering principles and guidelines to fulfil the structural requirements.

2.6.10.5.3. The concept of critical section shall be adopted for the successful design and economy in timber structures.

2.6.10.5.4. The allowable load for a bolt in a joint consisting of two members shall be taken as one half the allowable loads calculated for a three member joint for the same t′/d3 ratio (where t′ is the thickness of main member and d3 is the diameter of bolt). The percentage of safe working compressive stress of timber for bolted joints in double shear is shown in Table 2.6.10-1 below.

Table 2.6.10-1: Percentage of Safe Working Compressive Stress of Timber for Bolted Joints in Double Shear

Ratio (t'/d_3)	Stress Percentage	
	Parallel to Grain	Perpendicular to Grain
1	100	100
1,5	100	96
2	100	88
2,5	100	80
3	100	72
3,5	100	66
4	96	60
4,5	90	56
5	80	52
5,5	72	49
6	65	46
6,5	58	43
7	52	40
7,5	46	39
8	40	38
8,5	36	36
9	34	34
9,5	32	33
10	30	31
10,5	_	31
11	_	30
11,5	_	30

12	_	28

t′: Thickness of main member, mm d_3: Diameter of bolt, mm

2.6.10.5.5. The allowable loads shall be the sum of the allowable loads for the individual bolts where a number of bolts are used in a joint. Otherwise provision stated in 2.6.10.4.5 shall be applied.

2.6.10.5.6. The factors for different bolt diameter used in calculating safe bearing stress perpendicular to grain in the joint shall be as given in Table 2.6.10- 2.

Table 2.6.10- 2: Bolt Diameter Factor

No.	Diameter of Bolt (mm)	Diameter Factor (d_f)
1	6	5.70
2	10	3.60
3	12	3.35
4	16	3.15
5	20	3.05
6	22	3.00
7	25	2.90

2.6.10.5.7. The design of dimensions of timber members shall be as follows:

(i) The minimum thickness of the main member in mono-chord construction shall be 40mm;

(ii) The minimum thickness of side members shall be 20mm and shall be half the thickness of main members; and

(iii) The minimum individual thickness of spaced member in split-chord construction shall be 20mm and 25mm for webs and chord members, respectively.

2.6.10.5.8. The bolting of timber construction shall be as follow:

(i) The diameter of bolt in the main member shall be so chosen to give larger slenderness ratio of bolt;

(ii) There shall be more number of small diameter bolts rather than small number of large diameter bolts in a joint;

(iii) A minimum of two bolts for nodal joints and four bolts for lengthening joints shall be provided;

(iv) There shall be more number of rows rather than more bolts in a row;

(v) The bolt holes shall be of such diameter that the bolt can be driven easily;

(vi) Washers shall be used between the head of bolt and wood surface as also between the nut and wood.

2.6.10.5.9. The bolts shall be arranged in such a manner so as to pass the centre of resistance of bolts through the inter-section of the gravity axis of the members.

2.6.10.5.10. In case of members loaded parallel to grain of wood, staggering of bolts shall be done properly. The strength of connection will be increased if bolts are staggered correctly and spaced appropriately.

2.6.10.5.11. The bolt holes shall be bored or drilled perpendicular to the surface involved. Forcible driving of the bolts shall be avoided which may cause cracking or splitting of members.

2.6.10.5.12. Bolts shall be tightened after one year of completion of structure and subsequently at an interval of two to three years.

2.6.10.5.13. The bolts shall be arranged in such a manner so as to pass the centre of resistance of bolts through the inter-section of the gravity axis of the members.

2.6.10.5.14. In case of members loaded parallel to grain of wood, staggering of bolts shall be avoided as far as possible.

2.6.10.5.15. The bolt holes shall be bored or drilled perpendicular to the surface involved. Forcible driving of the bolts shall be avoided which may cause cracking or splitting of members.

2.6.10.5.16. Bolts shall be tightened after one year of completion of structure and subsequently at an interval of two to three years.

2.6.10.6. TIMBER CONNECTOR JOINTS

2.6.10.6.1. In large span structures, the members have to transmit very heavy stresses requiring stronger jointing techniques with metallic rings or wooden disc-dowels.

2.6.10.6.2. The thickness of main member shall be derived from the design considerations with length and width of members governed by placement of connector at joint.

2.6.10.6.3. The metallic connector shall be so placed that the loaded edge distance is not less than the diameter of the connector and the end distance not less than 1.75 times the diameter on the loaded side.

2.6.10.7. LAMINATED VENEER LUMBER

2.6.10.7.1. Sizes of laminated veneer lumber composite shall be inclusive of margin for dressing and finishing unless manufactured to order.

2.6.10.7.2. The margin for dressing and finishing shall not exceed 3mm in the width and thickness and 12mm in the length.

2.6.10.7.3. The strength requirements and loads resistance for laminated veneer lumber shall be designed in accordance with Part 6 Section 2 of this Code, and shall comply with ISO 22390.

2.6.10.7.4. The requirements of laminated veneer lumber shall be in accordance with the Table 2.6.10- 3 below.

Table 2.6.10- 3: Requirements of Laminated Veneer Lumber

S/N	Properties	Requirement
1	Modulus of rupture (N/mm^2) - Minimum	50
2	Modulus of elasticity (N/mm^2) - Minimum	7500
3	Compressive strength parallel to grain (N/mm^2) – Minimum	35
4	Compressive strength perpendicular to grain:	
	a) Parallel to grain (N/mm^2) - Minimum	35

	b) Perpendicular to grain (N/mm^2) - Minimum	50
5	Horizontal shear:	
	a) Parallel to laminae (N/mm^2) - Minimum	6
	b) Perpendicular to laminae (N/mm^2) - Minimum	8
6	Tensile strength parallel to grain (N/mm^2) - Minimum	55
7	Screw holding power:	
	a) Edge (N) - Minimum	2300
	b) Face (N) - Minimum	2700
8	Thickness swelling in 2 hr water soaking (%) - Maximum	3

2.6.10.8. GLUED LAMINATED MEMBERS

2.6.10.8.1. Glued laminated structural members shall be fabricated only where there is independently verified quality control, and there are adequate facilities for accurate sizing and surfacing of planks, uniform application of glue, prompt assembly, and application of adequate pressure and prescribed temperature for setting and curing of the glue.

2.6.10.8.2. Any other operation in connection with the manufacture or fabrication of glued structural members shall be in accordance with the available good practices and as per glue manufacturers' instructions as applicable.

2.6.10.8.3. Design and fabrication shall be in accordance with established good engineering practice and shall take into consideration the species and grade of timber used, presence of defects, location of end joints in laminations, depth of beams and moisture contents expected while in service.

2.6.10.8.4. During the design, the components, performance and production requirements shall be in accordance with ISO 12578.

2.6.10.8.5. Testing the glued laminated members shall be conducted for structural loading tests on prototype sizes provide information on the strength properties, stiffness or rigidity against deflection of a beam. The testing of glued laminated timber shall be conducted in accordance with ISO 12579 and ISO 12580.

2.6.10.8.6. Laminating boards shall not contain decay, knots or other strength reducing characteristics in excess of those sizes or amounts permitted by specifications.

2.6.10.8.7. Beams of large spans shall be designed with a suitable camber to assist in achieving the most cost effective section where deflection governs the design.

2.6.10.8.8. The strength and stiffness of laminated beams shall be governed by the quality of outer laminations.

2.6.10.9. PROTECTION AGAINST TERMITE ATTACK IN BUILDINGS

2.6.10.9.1. Prevention measures against termite attack shall be incorporated in the design and construction of buildings with timber elements.

2.6.10.9.2. Control measures shall consist of scientifically accepted methods such as isolating or sealing off the building from termites by chemical and nonchemical construction techniques.

2.6.10.9.3. The person in charge of the construction shall consider the following criteria while choosing the preservatives:

(i) Inflammability of treated timber is not increased and mechanical properties are not decreased;

(ii) Compatibility with the glue in laminated wood, plywood and board material;

(iii) Water repellent effect is preferred;

(iv) Possible suitability for priming coat;

(v) Possibility of painting and other finishes;

(vi) Non-corrosive nature in case of metal fasteners; and

(vii) Influence on plastics, rubber, tiles and concrete.

2.6.10.9.4. Protection against potential problem of termite attack can simply be carried out by ordinary good construction which prevents a colony from gaining access by:

(i) Periodic visual observations on termite galleries to be broken off;

(ii) Specially formed and properly installed metal shield at plinth level; and

(iii) Continuous floor slabs, apron floors and termite grooves on periphery of buildings.

SECTION 11: DESIGN OF BAMBOO STRUCTURES

2.6.11.1. GENERAL REQUIREMENTS

2.6.11.1.1. Prior the commencement of structural works of bamboos, the permit shall be obtained from the Building Consent Authority.

2.6.11.1.2. The structural design of bamboo shall be done by a qualified person as specified in Part 3 Section 2.

2.6.11.1.3. All mechanical and physical properties such as density, modulus of rupture, modulus of elasticity, compressive strength and moisture content for bamboos materials shall be determined in accordance with ISO 22157-1.

2.6.11.1.4. The structural design of bamboos shall comply with ISO 22156, and shall be used according to the Table 2.6.11 -1 below.

Table 2.6.11 -1: Structural Design Safe Working Stresses of Bamboos

S/N	Species	Extreme Fibre Stress in Bending (N/mm^2)	Modulus of Elasticity 10^3 (N/mm^2)	Allowable Compressive Stress (N/mm^2)
	GROUP A			
1	Bambusaglancescens (syn. B. nana)	20.7	3.28	15.4
2	Dendrocalamusstrictus	18.4	2.66	10.3
3	Oxytenantheraabyssinicia	20.9	3.31	13.3
	GROUP B			
4	Bambusabalcooa	16.4	1.62	13.3
5	B. pallid	13.8	2.87	15.4
6	B. nutans	13.2	1.47	13.0
7	B. tulda	12.8	1.77	11.6
8	B. auriculata	16.3	3.34	10.5
9	B. burmanica	14.9	2.45	11.4

10	Cephalostachyumpergracile	13.2	2.48	10.5
11	Melocannabaccifera (Syn. M. bambusoides)	13.3	2.53	15.4
12	Thyrsotachysoliveri	15.5	2.16	13.4
	GROUP C			
13	Bambusaarundinacea (Syn. B. bambos)	14.6	1.32	10.1
14	B. ventricosa	8.5	0.75	10.3
15	B. vulgaris	10.4	0.64	11.0
16	Dendrocalamuslongispathus	8.3	1.22	12.0

2.6.11.2. STRUCTURAL DESIGN OF BAMBOO

2.6.11.2.1. All structural members, assemblies or framework in a building shall be able to sustain all possible designed loading without exceeding the stress limits specified for the structure purpose.

2.6.11.2.2. All kinds of loads and forces by which any bamboo building is to be subjected on, shall be calculated in accordance with Part 6 Section 2 and ISO 22156.

2.6.11.2.3. The effects of loading such as buckling, deflection of bamboo structure on building members shall be taken into consideration while designing such structure.

2.6.11.2.4. While joining bamboo structural members; care shall be taken on round and tabular form of bamboo, diameter variation and wall thickness in design.

2.6.11.2.5. The bamboos used as trusses materials shall be able to sustain the loading subjected on them and shall be erected in a manner that the roof won't fail while subjected on wind loads.

2.6.11.3. STORAGE OF BAMBOO

2.6.11.3.1. Bamboos materials to be used in building construction shall be stored in an adequate ways to ensure the safety of workmen and all their properties.

SECTION 12: DESIGN OF STEEL STRUCTURES

2.6.12.1. PROVISIONS

2.6.12.1.1. All materials used in structural design of steel shall comply with the requirements specified in Part 7 Section 3 of this Code.

2.6.12.1.2. Design drawings shall show the complete details with sizes, sections, and the relative locations of the various members. Floor levels, column centres, and offsets shall be dimensioned.

2.6.12.1.3. Design drawings shall clearly distinguish between shop and field rivets, bolts and welds.

2.6.12.1.4. Design drawings shall be made in accordance with relevant parts of ISO 128 for technical drawings.

2.6.12.1.5. Design drawings shall indicate the data on the assumed loads, shears, moments and axial forces to be resisted by all members and their connections, as may be required for the proper preparation of shop drawings.

2.6.12.1.6. Any special precaution to be taken while erecting the structure shall also be indicated in the drawing from the design considerations.

2.6.12.1.7. A marking diagram allocating distinct identification marks to each separate part of steel work shall be prepared. That diagram shall be sufficient to ensure convenient assembly and erection at site.

2.6.12.1.8. Building materials to be used in structural steel such as rivets, welding consumables, steel castings, bolts and nuts, washers and steel tubes shall be in accordance with the specifications given in Part 7 Section 3 of this Code.

2.6.12.1.9. The hot/cold rolled and cold steel forming sections in structural steel shall be in accordance with RS ISO 134 and relevant parts of RS ISO 630.

2.6.12.1.10. The design procedure for welded hollow-section joints shall be in accordance with RS263.

2.6.12.1.11. The specifications of steel structures elements such as column bases, columns, beams, steel decks/floors and staircases in construction shall be in accordance with ASTM A123.

2.6.12.1.12. Stress sheets shall be prepared according to the appropriate occupancy class.

2.6.12.2. STEEL CONNECTIONS

2.6.12.2.1. The choice of steel structure connections shall depend on type of loading, strength and stiffness, and difficulty or ease of erection.

2.6.12.2.2. All splice connections in columns, crane girders shall be completely bolted or riveted or welded as specified in the drawing before erection.

2.6.12.2.3. The geometric parameters contributed to the imperfections of connections like bow in the beam or column as rolled; and lack of fit in black bolts in clearance holes shall be well verified on the structure.

2.6.12.2.4. The requirements for design and installation of bolts, screws, studs and nuts shall be in accordance with RS ISO 8992 and the special inspection of the installation of high strength bolts shall be provided by the Building Consent Authority.

2.6.12.2.5. Anchor rods shall be set accurately to the pattern and dimensions called for on the plans. The protrusion of the threaded ends through the connected material shall be sufficient to fully engage the threads of the nuts, but shall not be greater than the length of the threads on the bolts.

2.6.12.2.6. The bolts, screws and studs used in steel connection shall fulfil the requirements for mechanical properties complying with RS ISO 898-1, RS ISO 3506-2 and RS ISO 3506-1.

2.6.12.2.7. The design, test and techniques for a welded connection shall be in accordance with relevant parts of ISO 15614. And special inspection of welding shall be ensured by the Building Consent Authority. Riveted connections shall provide the resistance to different types of loading conditions and shall be in accordance with standard RS ISO 8992.

SECTION 13: CLADDING & GLAZING

2.6.13.1. GENERAL REQUIREMENTS

2.6.13.1.1. All design made for cladding structures shall be done by a qualified person.

2.6.13.1.2. Where any glazing is likely to be subjected to human impact, such glazing shall be toughened and the Building Consent Authority in charge may require evidence to be produced of such reinforcement by the owner of the building.

2.6.13.1.3. Any panel of glazing exceeding $1m^2$ in area in any building shall be constructed with safety glazing material.

2.6.13.1.4. In any building where a pane of glass is exposed to wind or a potential impact, the thickness of the glass shall be designed in accordance with Table 2.6.13-1.

2.6.13.1.5. The structural frame supporting the panel of glazing shall be capable of sustaining wind and others loads it might be subjected. The specification of material used in such frame for glasses shall be in accordance with Part 7 Section 3 of this Code.

2.6.13.1.6. Cladding materials such as ceramics tiles, aggregates and glazing materials shall conform to specifications given in Part 7 Section 3 of this Code.

2.6.13.1.7. All materials for glazing structures shall be waterproofed against all entering water in the building, fixed and positioned in a manner to resist all kinds of loads subjected on them.

2.6.13.1.8. A qualified person shall receive a guarantee from the specialist manufacturer that a full thermal safety movement check has been made related to the areas of glazing.

2.6.13.1.9. Glazing is well and safely installed in a building to avoid undue risk of injury to people.

2.6.13.2. PRINCIPLES OF CLADDING

2.6.13.2.1. A wholesome building shall provide an acceptable level of thermal comfort with minimal environmental impact.

2.6.13.2.2. The design of cladding structures shall comply with ASTM E1886-13a and shall be also tested for fire resistance in accordance with ISO 1182.

2.6.13.2.3. The cladding system shall be designed to provide a protected or exposed frame. And shall be also test to prove the intended design has adequate weather tightness.

2.6.13.3. STONE CURTAIN WALLING & EXTERNAL MASONRY CLADDING

2.6.13.3.1. All stone cladding installation shall conform to ASTM C1242-15 for buildings of over two storeys high.

2.6.13.3.2. The design and all work shall be done by the qualified person and the Building Consent Authority shall supervise every step.

2.6.13.3.3. The external masonry cladding in framed building/structure shall be securely anchored well to the structure.

2.6.13.3.4. In order to allow lateral force horizontal and relative movement in cladding, the movement joints shall be provided at intervals of not great than 10m.

2.6.13.3.5. The external masonry shall be supported on suitable beams, slabs at each storey and adequate provision shall be made for relative vertical movement between the masonry and the structure frame at the underside of such support.

2.6.13.3.6. Where the area of window openings in such panel is more than 20% of the face area of the panel calculated as the storey height multiplied by unsupported length, the top of the panel shall be anchored to the structure in a manner that will permit relative vertical movement but restrain the wall against later movement.

2.6.13.4. FIXING AND TYPE OF GLAZING

2.6.13.4.1. Glazing materials shall be manifested, positioned fixed and marked in conformity with ISO 28278-2.

2.6.13.5. INSTALLATION OF GLAZING

2.6.13.5.1. The installation of a pane of glasses in a glazing structure without frame support shall conform to ISO 28278-1.

2.6.13.5.2. The installation of vertical glazing and the fastening of pane of glass shall be in accordance with the following requirements:

(i) The vertical glazing structures shall be installed in the way to sustain all designed loads to be supported;

(ii) ISO 28278-2 describes all worthy methods and the way that such pane of glasses shall be fastened in the frame ; and

(iii) The nominal thickness of such pane shall be at least designed for installation of size given in Table 2.6.13-1 below.

Table 2.6.13-1 Nominal Thickness of Panes

Nominal Glass Thickness (mm)	Maximum Size Panel (m^2)
3	0.75
4	1.5
5	2.1
6	3.2

2.6.13.5.3. The installation of glazing materials shall be done in manner that no incidental loads shall be subjected on them.

2.6.13.5.4. Patterned glass, regular plate, sheet in louvered windows designation shall not be thinner than nominal 5.6mm and not longer than 1.2m. For other glass types are used, design shall be submitted to the supervising Building Consent Authority for approval. Exposed glass edges shall be smooth.

2.6.13.6. GLAZING SAFETY & DOORS

2.6.13.6.1. Glazed area installed in doors shall not exceed $1m^2$ where those areas are not made by safety glasses and shall have the nominal thickness not less than 0.6m.

2.6.13.6.2. Where any glazed window or glazed curtain wall are not guarded by barriers to reduce possibility of persons coming into contact with them, the supporting structure shall be at level not less than 0.8m and safety glasses shall be required.

2.6.13.7. GLAZING OF OPENINGS

2.6.13.7.1. SKYLIGHTS

2.6.13.7.1.1. The skylights shall be installed within 3m of heights and for plastics skylights, the distance separated two of them shall be at least 2.5m laterally and 3m along the slope of the roof.

2.6.13.7.1.2. For skylights installation on roofs, the building shall be equipped with automatic fire-extinguishing system and for plastics used as glazing materials, are used as fire-ventilation system. For one storey buildings, plastics may also be used in skylights.

2.6.13.8. SIGNIFICANT POSITION RELATED TO GLAZING

2.6.13.8.1. In terms of safety, the possible significant position shall be considered as follow between finished floor levels:

(i) And 0.8m above that level in internal and external walls and partitions;

(ii) And 1.5m above that level in a door and in a side panel, close to either edge of the door.

2.6.13.8.2. In order to reduce the risks in the significant position, glazing shall be either robust or permanently protected so as to avoid the damage if it breaks.

2.6.13.9. ARCHITECTURAL CONSIDERATIONS

2.6.13.9.1. Where a glazing structure is designed to be an exit, this last shall be designed with approved safety glazing.

2.6.13.9.2. All technical works for glazing design related to the use of glasses in building construction shall be in accordance with relevant parts of ISO 28278.

2.6.13.9.3. The specifications of curtain walling during cladding or glazing shall be in accordance with ASTM E1886-13a.

2.6.13.10. STRUCTURAL LOADING FACTORS

2.6.13.10.1. Cladding structural components that are either directly or indirectly loaded by wind forces from the close places shall be in the way to resist those forces system.

2.6.13.10.2. Glazing components for windows, doors, curtain walls and all cladding made of glasses sloped at 15 degree or less shall be designed in the way to resist wind loads.

2.6.13.11. The engineer in charge of designing glazing structures shall consider the wind speed calculations and the earthquake prone zone as well as all factors of correlations.

2.6.13.12. GLAZED CURTAIN WALLING

2.6.13.12.1. Curtain walling system shall be designed to support either vertical or horizontal structural members to resist lateral loads.

2.6.13.12.2. The installation of curtain walling glazing in building shall comply with the following ISO 28278-2 and no glazing for curtain walling shall be less than 6mm thick for buildings over two storeys.

2.6.13.12.3. All mechanical fixings of systems over 20m high are to be stainless steel or any other non-corrosive material.

2.6.13.12.4. For curtain walling cladding, the specification of structural design shall conform to ASTM E1886-13a.

2.6.13.12.5. The frame of the curtain walling system shall be designed as panel walls by taking into consideration the actual supporting conditions.

SECTION 14: SYSTEM BUILDINGS & MIXED/COMPOSITE CONSTRUCTION

2.6.14.1. MATERIAL & GENERAL REQUIREMENTS

2.6.14.1.1. In mixed/composite construction, there shall be sampling procedure, testing on individual components, load testing of structure and the equipment shall be in accordance with Part 7 Section 3.

2.6.14.1.2. The selection of materials to use in system building and mixed/composite structures shall be conducted by considering the following characteristics:

(i) Light weight for easy handling and transport;
(ii) Thermal insulation property and Sound insulation;
(iii) Durability;
(iv) Non-combustibility;
(v) Economy; and
(vi) Any other special requirement in a particular application.

2.6.14.2. DESIGN & PLANNING GUIDELINES

2.6.14.2.1. Every drawing shall describe the essentials elements of the structure and assembly including all required data of physical properties of component materials. The planning, modular co-ordination, architecture and finishes shall respect the technical guidelines of structures in accordance with approved standards for each type of structure.

2.6.14.2.2. The specifications of casting or erection, tolerance and type of curing in mixed construction shall be in accordance with the provisions of each type of materials and structures.

2.6.14.2.3. The construction elements like joints shall be analysed appropriately and designed to resist the forces of an equivalent discrete system.

2.6.14.2.4. The beams, walls and bracings in two directions at right angles or otherwise shall be placed in order to support horizontal loadings.

2.6.14.2.5. The components of composite construction shall be designed by taking into consideration the appropriate end conditions and loading at various stages of construction and shall also be designed to resist all the forces and effect that will act on them in accordance with Part 6 Section 2.

2.6.14.2.6. The following factors shall be considered for mixed and composite construction:

(i) Positions of stability cores, walls, bracing;
(ii) The availability and/or positioning of equipment to transport and erect components;
(iii) Erection safety and speed of construction, with attention to cast in-situ concreting sequences; and
(iv) Tolerances for economical construction.

2.6.14.3. SYSTEM AND STRUCTURAL SCHEMES

2.6.14.3.1. The design of system and structural schemes shall consider the following aspects in order to respect the degree of flexibility:

(i) Effective utilization of spaces and straight and simple walling scheme;
(ii) Limited sizes, numbers of components and opening in bearing walls;
(iii) Regulated locations of partitions and standardized service and stair units;
(iv) Limited sizes of doors and windows with regulated positions;
(v) Structural clarity and efficiency and suitability for adoption in low and high rise building;
(vi) Ease of manufacturing, storing and transporting; and
(vii) Speed and ease of erection and simple jointing system.

2.6.14.3.2. Steel wire mesh, and suitable crane shall be used as structural reinforcement in order to implement the tunnel form system efficiently and the tunnel form system installation shall be also accelerated by rebar works at steel prefabrication area.

2.6.14.3.3. A slip-form assembly must be only start after the foundations of the walls have been correctly laid and a starter for the walls laid out in its correct alignment with all the necessary steel for the walls already in position.

2.6.14.3.4. The slip-form shall be erected so as to maintain its rigidity and shape for the entire structure.

2.6.14.3.5. Every component of aluminium formwork shall be handled easily and safely in order to avoid damage and losses due to the equipment.

2.6.14.3.6. All formwork of large panel shuttering system shall be provided with supports designed for the loads coming during the actual execution stage.

2.6.14.4. FORMWORK SYSTEMS

2.6.14.4.1. The dimensions and combination possibilities of the panels shall ensure an accurate fit of the formwork to the structure to be shuttered and the structural design and the profiles used shall be identical for all panels.

2.6.14.4.2. Any new system may be used for systems building after being examined and approved by the Building Consent Authority.

2.6.14.5. SYSTEMS FOR COMPOSITE CONSTRUCTION

2.6.14.5.1. The composite construction of precast and is-situ concrete shall be well constructed in accordance with the requirements of Part 6 for concrete and prefabricated concrete and several standards listed in this Code.

2.6.14.5.2. The design of structural steelwork are used for long span pre-stressed concrete floors supported on rolled and prefabricated steel shall be suitable to resist all kind of loading specified in Part 6 of this Code.

2.6.14.5.3. In building system, the design of timber frame for precast floors, long span glue laminated beams and rafters shall comply with the requirement of design and construction of floors as specified in Part 6 Section 10 of this Code.

2.6.14.5.4. The mixed construction of floors with brick and block masonry combined with precast concrete structures shall be designed for reliable use and for the safety in accordance with the relevant standards for each structure.

SECTION 15: SPECIAL STRUCTURAL CONSTRUCTIONS

2.6.15.1. GENERAL REQUIREMENTS

2.6.15.1.1. No person shall erect structure without first obtaining a license from the approved Building Consent Authority.

2.6.15.1.2. In case of buildings having special structural features, as decided by the Building Consent Authority, which are within the horizontal areas and vertical limits specified in Part 4 Section 5 of this Code shall be designed only by a qualified person.

2.6.15.1.3. The free form structures shall be designed by considering provisions of relevant sections of Part 6 and Part 7 of this Code.

2.6.15.2. MEMBRANE STRUCTURES

2.6.15.2.1. Non-combustible frame or cable supported structures covered by membranes which satisfy the non-combustibility test in accordance with ISO 1182 and non-combustible membranes shall be classified in construction type of building made by non-combustible materials.

2.6.15.2.2. Heavy timber frame supported structures covered by membranes which conform to specification of non-combustibility test in accordance with ISO 1182, shall be classified in class of buildings with that type of construction in which the exterior walls are of non-combustible materials and the interior building elements are of solid or laminated wood without concealed spaces.

2.6.15.2.3. Other membranes shall be classified in class of building with materials not specified in type of construction except for plastic less than 9 m with a thickness not less than to 0.5 mm used in greenhouses, for aquacultures pond covers and where public access is not allowed, those plastics don’t require being in accordance with standard ISO 1182.

2.6.15.2.4. The area and the maximum height of a membrane structures shall not exceed the limitations given in Part 4 Section 5 of this Code which specifies the classification and type of construction, except membranes which serve for roofing structures.

2.6.15.2.5. All membrane which conforms to ISO 1182 and which are non-combustible shall be used as roof structures or skylight of any building provided that it is placed at least to 6m above any floor.

2.6.15.2.6. A qualified person who is in charge of the design and analysis of membranes structures shall take into consideration all kinds of loads in accordance with Part 6 Section 2 of this Code.

2.6.15.2.7. Air-supported & air-inflated structures shall be provided with primary and auxiliary inflation system with conditions to meet requirements specified below:

(i) In order to maintain required pressure and prevent over pressurization, the system shall consist of one or more blowers and designed with an automatic control to do so.

(ii) Auxiliary inflation shall be designed with capacity to maintain the equilibrium of the inflation system in case of primary system failure and shall operate automatically where there is an internal pressure loss in a primary system.

2.6.15.2.8. Air-supported and air-inflated structures having an occupant load of 50 persons or more shall be provided a system capable of supporting the membrane in case of deflation. That system shall be capable to maintain the membranes structures used as roof on building made with non-combustible materials and other membranes for at least 6m and 2m above the floor respectively.

2.6.15.3. TEMPORARY STRUCTURES

2.6.15.3.1. Temporary structures, tents and other membrane structures erected for a period of limited time shall be designed to ensure safety user consideration and shall be approved by the Building Consent Authority.

2.6.15.3.2. Temporary structures that cover an area in excess of $12m^2$ shall be in accordance with Part 3 Section 5 of this Code.

2.6.15.3.3. DESIGN AND CONSTRUCTION REQUIREMENTS OF CANOPY:

(i) A canopy shall be not less than 3.5m above the level of the footway;

(ii) A canopy shall not extend outwards from the building so as to be nearer the vertical plane of the kerbed line of such footway than 0.6m;

(iii) A canopy shall be of an approved design and construction;

(iv) Every canopy constructed within 1.5m of the outer edge of a footpath, or projecting over a road, shall have a clear space of not less than 5m beneath every part thereof;

(v) Every canopy built along the footpath shall have a sitting place of 10 persons

(vi) Every canopy erected over a footpath shall have a clear space of not less than 3m beneath every part thereof; and

(vii) The canopies shall be designed so that they are able to resist on imposed loads such as wind load, lateral loads and live loads

2.6.15.3.4. If it is considered by the Building Consent Authority that a canopy shall be erected in front of a new building, the Building Consent Authority may require the owner thereof to provide for it in the design of such building.

2.6.15.3.5. The upper surface of every canopy, shall be impervious to moisture and drained in an approved manner, and designed to prevent the discharge of water directly onto a street. Unless the approving Building Consent Authority otherwise approves, no load shall be placed upon a canopy.

2.6.15.3.6. Other tensile structures shall be designed and constructed in a manner that the health safety of the users is ensured and shall be approved by the Building Consent Authority.

2.6.15.3.7. WELDING OF CANOPY

Where a canopy is constructed in steel material, the use of welding in the fabrication of structural steel work shall only be permitted with the express approval of the Building Consent Authority and the design shall comply with Part 6 Section 12of this Code.

2.6.15.3.8. DOORWAYS OF CANOPY

No doorway giving direct access to the top of any canopy shall be made in the external wall of any building.

2.6.15.3.9. USE OF VERANDAS OR BALCONIES

Where any veranda or balcony has been built over or upon any street no such veranda or balcony shall be used or adapted to be used as a factory, workshop, storeroom, kitchen, lavatory, bathroom, water-closet, urinal or latrine.

2.6.15.3.10. Awnings and canopies shall be designed and constructed to withstand wind or other lateral loads and live loads as required by structural design; structural members shall be protected to prevent deterioration.

2.6.15.3.11. Awnings shall have frames of non-combustible material, fire-retardant-treated wood. Wood construction with combustible or non-combustible covers and shall be fixed, retractable, folding or collapsible.

2.6.15.3.12. Canopies shall be made of a rigid framework with an approved covering that meets the fire propagation requirements specified in ISO 1182 of fire tests for flame-propagation of textiles and films this shall comply with Part 8 Section 3 of this Code.

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2.6.15.4. PORTAL CRANE GIRDERS

2.6.15.4.1. The truss or girder shall be designed to safety sustain the steps and running gear in operation. In the event of failure of the track system it shall retain the running gear in its guides.

2.6.15.4.2. For crane gantry girders, the following allowances shall be used to cover all forces set up by vibration, shock from slipping of slings, kinetic action of acceleration and retardation and impact of wheel loads:

(i) For loads acting vertically, the maximum static wheel loads increased by 25% for an electric overhead crane or 10% for a hand operated crane;

(ii) For the horizontal force acting transverse to the rails, the following percentage of the combined weight for the crab and the load lifted:

a. 10% for an electric overhead crane; or

b. 5% for a hand-operated crane;

(iii) For the horizontal forces acting along the rails, 5% of the static wheel loads which can occur on the rails, for overhead cranes which are either electric or hand-operated.

2.6.15.4.3. The forces specified in either 2.6.15.5.2 (ii) or (iii) above shall be considered as acting at the rail level and being appropriately transmitted to the supporting systems.

2.6.15.4.4. Either of the horizontal forces 2.6.15.5.2 (ii) or (iii) above shall act at the same time as the vertical load on gantry girders and their vertical supports.

2.6.15.4.5. CRANE INSTALLATION

The installation of the portal crane girder is due to the purpose or the function or the volume of work, in any vertical or horizontal portal crane girder installation, any part of crane or steel piece of crane shall be well welded or bolted in order to get the required strength, and the fixing of such parts comply with the following requirements:

(i) Where the portal crane girder is to be exposed to the wind, the installation shall take care to direction of the wind load; and

(ii) The portal crane girder shall be well fixed on the strong foundation which is in reinforced concrete structure.

2.6.15.5. TUNNELS & PEDESTRIAN WALKWAYS

2.6.15.5.1. This subsection shall apply to connections between buildings such as pedestrian walkways or tunnels that are used as a means of travel by persons. The pedestrian walkway shall not contribute to the building area or height of connected buildings.

2.6.15.5.2. Connected buildings shall be considered to be separate structures excluding the buildings on the same lot.

2.6.15.5.3. The pedestrian walkway shall be of non-combustible construction exclude where connected buildings are of combustible construction and fire-retardant-treated wood, in accordance with table of fire-resistance rating requirements that are permitted for the roof construction of the pedestrian walkway in accordance with Part 8 Section 2 of this Code.

2.6.15.5.4. All materials and decorations used on the pedestrian walkway shall be approved by the institution in charge of standard for materials of construction.

2.6.15.5.5. Walkways shall be separated from the interior of the building by fire-barrier walls with a fire-resistance rating of not less than 2 hours constructed in accordance with Part 8 Section 2 of this Code. This protection shall extend vertically from a point of 3m above the walkway roof surface or the connected building roof line, whichever is lower, down to a point of 3m below the walkway and horizontally 3m from each side of the pedestrian walkway.

The exception shall be when the walls separating the pedestrian walkway from a connected building are not required to have a fire-resistance rating by this section where the following provisions can be applied: The distance between the connected buildings is more than 3m and both sidewalls of the pedestrian walkway are at least with 50% open area uniformly distributed to prevent the accumulation of smoke and toxic gases.

2.6.15.5.6. The unobstructed width of pedestrian walkways shall not be less than 1m. The total width shall not exceed 9m.

2.6.15.5.7. The tunnelled walkway and the building, to which it is connected, shall be separated by not less than 2 hour fire-resistant construction and openings shall be protected.

2.6.15.6. MARQUEES

2.6.15.6.1. The vertical upper limit of the marquee shall be at most 9m where the marquee projects more than two-thirds of the distance from the property line to the curb line, and shall be less than 3m where the marquee is less than two-thirds of the distance from the property line to the curb line.

2.6.15.6.2. The horizontal clearance between a marquee and the kerb line shall not be less than 0.6m.

2.6.15.6.3. A marquee shall be constructed by non-combustible materials and shall be supported entirely from the building.

2.6.15.7. TELECOMMUNICATION & BROADCAST TOWERS

2.6.15.7.1. The design and construction of telecommunication towers shall be in accordance with RS 281.

2.6.15.7.2. The supports for antennas not greater than 24m of height measured from the top of the pole to grade shall not be required to be non-combustible.

2.6.15.8. SWIMMING POOL

2.6.15.8.1. For structural design, the pool structure shall be engineered and designed to withstand the expected forces to which it will be subjected.

2.6.15.8.2. A swimming pool or appurtenances thereto shall not be constructed, installed, enlarge or altered until plans have been submitted and a permit has been obtained from the Building Consent Authority. Certified copies of these approvals shall be filed as part of the supporting data for the application for the permit.

2.6.15.8.3. The design of plans shall take into account the dimensions and construction of the pool and appurtenances and properly established distances to plot lines, buildings, walks and fences, and also the details of the water supply system, drainage and water disposal systems.

2.6.15.8.4. It is required to have an adequate enclosure or a barrier either surrounding the property or pool area, sufficient to make such water body inaccessible to small children. Such enclosure, including gates therein, shall be not less than 1m above the underlying ground. All gates shall be self-closing and self-latching with latches placed 1m above the underlying ground and otherwise made inaccessible from the outside to small children and the diameter of openings in the barrier shall not exceed 0.1m spherically.

2.6.15.8.5. All public swimming pools shall have walkways not less than 5m in width extending entirely around the pool. Where kerbs or sidewalks are used around any swimming pool, they shall have a slip-resistant surface for a width of not less than 0.3m at the edge of the pool, and shall be so arranged to prevent return of surface water to the pool.

2.6.15.8.6. Minimum water depths and distances for diving hoppers for pools, based on board height above water and the installation shall be approved by the Building Consent Authority.

2.6.15.9. AUTOMATIC GATES

Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of standard specification for automated vehicular gate construction.

RWANDA BUILDING CODE

Chapter Two:
STRUCTURE & BUILDING MATERIALS

PART 7:

BUILDING MATERIALS

SECTION 1: GENERAL REQUIREMENTS
SECTION 2: STRUCTURAL MATERIALS
SECTION 3: MATERIALS SPECIFICATIONS & TESTING
SECTION 4: USED, SECONDARY & ALTERNATIVE MATERIALS
SECTION 5: NON-COMPLIANCE

CONTENTS

PART 7: BUILDING MATERIALS

SECTION 1: GENERAL REQUIREMENTS

2.7.1.1. The requirements for acceptable construction materials shall be satisfied if the use, method of mixing, preparation, application, or fixing comply with the provision of approved Standards.

2.7.1.2. No person shall use or permit or cause to be used in the erection of a building and related external works, any material or component which is not of a suitable nature and quality for the purpose for which it is used and adequately mixed, fixed or prepared in a proper manner so as adequately perform the functions for which it was designed.

2.7.1.3. Any person who contravenes or fails to comply with the provisions of sub-regulation 2.7.1.2 shall be guilty of an offence and shall be liable upon conviction as provided for in Parts 3 and 5 of this code.

2.7.1.4. The Building Consent Authority may test or cause to be tested any material or component used or to be used in order to ascertain whether such material or component complies with the requirements of these regulations. For this purpose the Building Consent Authority may, at any time after consultation with the person erecting such building, remove from the building site concerned a sample of such material or component as is reasonably necessary for the purpose of such test and in such a way that work of such erection is not stopped when such material or component is being so removed and tested.

2.7.1.5. In the event of contravention of sub-regulations 2.7.1.1 and 2.7.1.2, the Building Consent Authority may, by a written notice served upon the owner of any building in which material is used, require the removal of any such material.

2.7.1.6. Any material pronounced as hazardous by the Building Control Authority shall not be used as building material. The use of asbestos materials has been found to be hazardous to health; their application in building construction shall, if at all allowed, be approved by the Building Control Authority. .

2.7.1.7. STORAGE OF BUILDING MATERIALS

2.7.1.7.1. All building materials shall be stored in such a way as to prevent deterioration, the loss or impairment of their structural and other essential properties.

SECTION 2: STRUCTURAL MATERIALS

2.7.2.1. Any material used in the construction of any structural element or component thereof shall be that specified in relevant standard; where such standard has been used as a basis for structural design.

2.7.2.2. Where materials specified in such standard are not available, alternative materials of equal standard or better performance may be used if they meet requirements in that standard but shall have to be approved by the Building Control Authority (or Building Consent Authority as applicable) in collaboration with the institution in charge of standards.

SECTION 3: MATERIALS SPECIFICATIONS & TESTING

2.7.3.1. GENERAL REQUIREMENTS

2.7.3.1.1. All buildings materials shall be tested in accordance with relevant standards and/or guidelines.

2.7.3.1.2. The producer and/or supplier of building materials shall ensure that the building materials they produce or supply comply with relevant standards and/or guidelines.

2.7.3.1.3. If any material or component is tested and is found not to comply withthe provision of this code, the Building Consent Authority may serve a notice on such person that used the material or component, stating the respects in which such material or component does not comply and prohibiting such person from making further use of such material or component for the purpose for which it was or is to be used in the erection of such building and such person shall forthwith on receipt of such notice remove such material or component from such building or building site or from both, as the case may be.

2.7.3.1.4. If any material or component contemplated in sub-regulation 2.7.3.1.3 is tested and found to have failed to comply with the provision of this code, the Building Consent Authority shall recover the cost of such test from the owner of the building or construction concerned.

2.7.3.1.5. The requirements and specifications of several commonly used building materials where not specified in the relevant sub-regulation(s) shall be in accordance with the following standards; without jeopardising the use of other materials with respect to section 4 of Part 7 of this Code.

ALUMINIUM, OTHER LIGHT METALS AND THEIR COMPOSITES

Aluminium:

ISO 6361	Wrought aluminium and aluminium alloys — Sheets, strips and plates
ISO 6362	Wrought aluminium and aluminium alloys — Extruded rods/bars, tubes and profiles
ISO 6363-2	Wrought aluminium and aluminium alloys — Cold-drawn rods/bars and tubes and wires — Part 2: Mechanical
ISO 2107	Designation of aluminium and aluminium alloys and the temper designation
ISO 6361-5	Chemical composition of wrought aluminium and aluminium alloys.
ISO 25239-2	Friction stirs welding. Aluminium —Design of weld joints
ISO/TR 15608	Welding — Guidelines for a Metallic materials grouping system
ISO 9606-2	Qualification test of welders. Fusion welding — Aluminium and aluminium alloys.

TIMBER

RS EAS 23	Dimensions for coniferous sawn timber (cypress and pine): Sizes of sawn and planed timber: Specification
RS EAS 272	Determination of moisture content for physical and mechanical tests

RS EAS 273	Sampling methods and general requirements for physical and mechanical tests
RS EAS 272	Determination of moisture content for physical and mechanical tests
RS EAS 272	Determination of volumetric swelling
RS EAS 273	Sampling methods and general requirements for physical and mechanical tests
RS EAS 274	Determination of the average moisture content
RS EAS 275	Determination of volumetric shrinkage
RS EAS 277	Determination of radial and tangential shrinkage
RS EAS 278	Determination of radial and tangential swelling

PLASTICS

RS EAS 480	Film and sheeting —Determination of thickness by mechanical scanning
RS IS0 4612	Preparation of PVC pastes for test purposes — Planetary-mixer method

ROOF COVERS

Tiling materials:

RS EAS 71	Clay roofing tiles — Specification
RS EAS 422-4	Ceramic tiles — Part 4: Determination of modulus of rapture and breaking strength
RS EAS 422-5	Ceramic tiles — Part 5: Determination of impact resistance by measurement of coefficient of restitution
RS EAS 422-10	Ceramic tiles —Part 10: Determination of moisture expansion

RS EAS 422-11	Ceramic tiles —Part 11: Determination of crazing resistance for glazed tiles
RS EAS 422-12	Ceramic tiles —Part 12: Determination of frost resistance
RS EAS 422-13	Ceramic tiles —Part 13: Determination of chemical resistance
RS EAS 422-14	Ceramic tiles —Part 14: Determination of resistance to stains
RS EAS 422-15	Ceramic tiles —Part 15: Determination of lead and cadmium given off by glazed tiles
RS EAS 422-16	Ceramic tiles —Part 16: Determination of small colour differences
RS EAS 422-3	Ceramic tiles —Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density
RS EAS 422-6	Ceramic tiles —Part 6: Determination of resistance to deep abrasion for unglazed tiles
RS EAS 422-7	Ceramic tiles —Part 7: Determination of resistance to surface abrasion for glazed tiles
RS EAS 422-8	Ceramic tiles —Part 8: Determination of linear thermal expansion
RS EAS 422-9	Ceramic tiles —Part 9: Determination of resistance to thermal shock

Steel Sheets:

RS ISO 4995	Hot-rolled steel sheet of structural quality: Specification
RS ISO 4997	Cold reduced steel sheets of structural quality
RS ISO 4998	Continuous hot-dip zinc-coated carbon steel sheet of structural quality
RS EAS 196	High-strength low — alloy Carbon Steel for hot-rolled sheet and cold-rolled sheet — Specifications

AGGREGATES

RS EAS 180	Specification for aggregates from natural sources for use in concrete
RS 96-10	Methods of test for aggregates — Part 10: Method of determination of acid soluble material in fine aggregates
RS 96-2	Methods of testing aggregates — Part 2: Guide to sampling and testing aggregates
RS 96-3	Methods of testing aggregates — Part 3: Methods of sampling
RS 96-7	Methods of test for aggregates — Part7: Methods for determination of moisture content
RS 96-1	Methods of test for aggregates — Part 1: General requirements for apparatus and calibration
RS 96-11	Methods of test for aggregates — Part 11: Method of testing and classifying the drying shrinkage of aggregate for use in concrete
RS 96-4	Methods of test for aggregates — Part 4: Methods for determination of particle size distribution, sieve test
RS 96-5	Methods of test for aggregates — Part 5: Methods for the determination of particle shape — Flakiness index
RS 96-6	Methods of test for aggregates — Part 6: Methods of determination of shell content in coarse aggregates
RS 96-8	Methods of test for aggregates — Part 8: Methods for determination of ten percent fines value
RS 96-9	Methods of test for aggregates — Part 9: Methods for determination of aggregates impact value

BRICKS AND BLOCKS

RS 144	Cement blocks and Bricks — Specification
RS EAS 54	Burnt building bricks — Specifications

RS EAS 179	Precast concrete paving blocks — Specification
RS EAS 94	Burnt clay building blocks — Specification

STEEL

RS ISO 4948-1	Steel - Classification — Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition
RS ISO 4948-2	Steel - Classification — Part 2: Classification of steels into unalloyed and alloy steels according to main quality classes and main property or application characteristics
RS ISO 15630-1	Steel for the reinforcement and prestressing of concrete — Test methods
RS ISO 6935-2	Steel for the reinforcement of concrete — Part 2: Ribbed bars
RS ISO 16020	Steel for the reinforcement and prestressing of concrete — Vocabulary
RS ISO 6934-1	Steel for the prestressing of concrete —Part 1: General requirements
RS ISO 6934-2	Steel for the prestressing of concrete —Part 2: Cold-drawn wire
RS ISO 6934-3	Steel for the prestressing of concrete —Part 3: Quenched and tempered wire
RS ISO 6934-4	Steel for the prestressing of concrete — Part 4: Strand
RS 63	Carbon steel for reinforcement of concrete — Specification
RS EAS 412-1	Steel bars for reinforcement of concrete — Part 1: Plain bars
RS EAS 412-2	Steel bars for reinforcement of concrete — Part 2: Ribbed bars
RS EAS 412-3	Steel bars for reinforcement of concrete — Part 3: Welded fabric
RS ISO 10065	Steel bars for reinforcement of concrete — Bend and rebend tests

METALLIC

RS ISO 6892-1	Metallic materials — Tensile testing — Part 1: Method of test at room temperature
RS ISO 6892-2	Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature
RS EAS 189	Metallic materials — Tensile testing
RS EAS 192-1	Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines-Verification and calibration of the force measuring system
RS EAS 192-2	Metallic materials — Verification of static uniaxial testing machines — Part 2: Tension creeping testing machines — Verification of the applied load
RS EAS 201-1	Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)

CONCRETE

RS ISO 1920-5	Methods of testing concrete
RS EAS 131-1	Part 1: Specification, performance, production and conformity
RS EAS 417-1	Part 1: Methods of specifying and guidance for the specifier
RS EAS 417-2	Part 2: Specification of constituent materials, production of concrete and compliance of concrete

CEMENT

RS EAS 18-1	Cements —Part 1: Composition, specification and conformity criteria for common cements

RS EAS 18-2	Cements— Part 2: Conformity evaluation
RS EAS 148-1	Cements — Test methods— Part 1: Determination of strength
RS EAS 148-2	Cements — Test methods— Part 2: Chemical analysis
RS EAS 148-3	Cements — Test methods— Part3: Determination of setting time and soundness
RS EAS 148-4	Cement — Test methods— Part 4: Quantitative determination of constituents
RS EAS 148-5	Cement — Test methods— Part 5: Pozzolanicity test for pozzolanic cements
RS EAS 148-6	Cement— Test methods— Part 6: Determination of fineness
RS EAS 148-7	Cement — Test methods— Part 7: Methods of taking and preparing
RS EAS 148-8	Cement — Test methods— Part 8: Determination of chlorine, carbon dioxide and alkali content of the cement

STONES

ASTM C615/C615 M-11	Specification for granite
ASTM C97/C97 M-09	Testing methods for absorption and bulk specific gravity of dimension stone
ASTM C170/C170 M-09	Test method for compressive strength of dimension stone

BAMBOO

ISO/TR 22157-2	Mechanical and physical properties testing
ISO 22157-1	Specifications for bamboo treatment

GLASS

ISO 14439	Glass in building assembly rules glazing wedges
ISO 9050	Glass in building- Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors
ASTM C1036-11e1	Types and quality requirements of glass

PLUMBING MATERIALS

RS EAS 419	Concrete pipes and fittings, unreinforced, steel fibre and reinforced
RS EAS 426-2	Concrete pipes and ancillary concrete products —Part 2: Specification for unreinforced and reinforced concrete manholes and soak ways
RS EAS 426-4	Concrete pipes and ancillary concrete products —Part 4: Specification for prestressed non-pressure pipes and fittings with flexible joints
RS EAS 426-5	Precast concrete pipes and ancillary concrete products —Part 5: Specification for ogee pipes and fittings (including perforated)
RS EAS 426-6	Precast concrete pipes, fittings and ancillary products —Part 6: Specification for porous pipes
RS EAS 426-1	Concrete pipes and ancillary concrete products —Part 1: Specification for unreinforced and reinforced concrete pipes (including jacking pipes) and fittings with flexible joints
RS EAS 426-3	Concrete pipes and ancillary concrete products —Part 3: Specification for unreinforced and reinforced concrete inspection chambers
RS EAS 426-7	Precast concrete pipes and ancillary concrete products —Part 7: Specification for road gullies and gully cover Slabs

RS ISO 2531	Ductile iron pipes, fittings, accessories and their joints for water applications
RS ISO 4427-1	Plastics piping systems —Polyethylene (PE) pipes and fittings for water supply —Part 1: General specifications
RS ISO 1452-1	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized polyvinyl chloride (PVC-U) — Part 1: General
RS ISO 1452-2	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized polyvinyl chloride (PVC-U) — Part 2: Pipes
RS ISO 1452-3	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized polyvinyl chloride (PVC-U) — Part 3: Fittings
RS ISO 1452-4	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure — Unplasticized polyvinyl chloride (PVC-U) — Part 4: Valves
RS ISO 1452-5	Plastics piping systems for water supply and for buried and above-ground drainage
RS ISO 6594	Cast iron drainage pipes and fittings — Spigot series

SECTION 4: USED, SECONDARY & ALTERNATIVE MATERIALS

2.7.4.1. Used, secondary and alternative materials shall be encouraged to minimise waste on-site while optimising the use of available materials.

2.7.4.2. Used, secondary and alternative structural or non-structural materials shall be used in building operations if they meet the design requirements for materials and are approved by the Building Control Authority in collaboration with the institution in charge of standards. Subject to the provision of this sub-regulation, no used or secondary material shall be used on work to which the provisions of this Code apply unless it is approved by the Building Control Authority (or Building Consent Authority as applicable) in partnership with the institution in charge of standards.

SECTION 5: NON-COMPLIANCE

2.7.5.1. If any material or component is suspected not to comply with this Code, the Building Consent Authority may serve a notice on such person to stop temporarily the use of such material.

2.7.5.2. The Building Consent Authority shall proceed by testing the suspected material and it may recover the cost of such test from the owner of the building if the material fails to comply.

2.7.5.3. The Building Consent Authority, shall provide notice to such person stating the respects in which such material or component do not comply and prohibiting such person from making further use of such material or component for the purpose for which it was or is to be used in the erection of such building.

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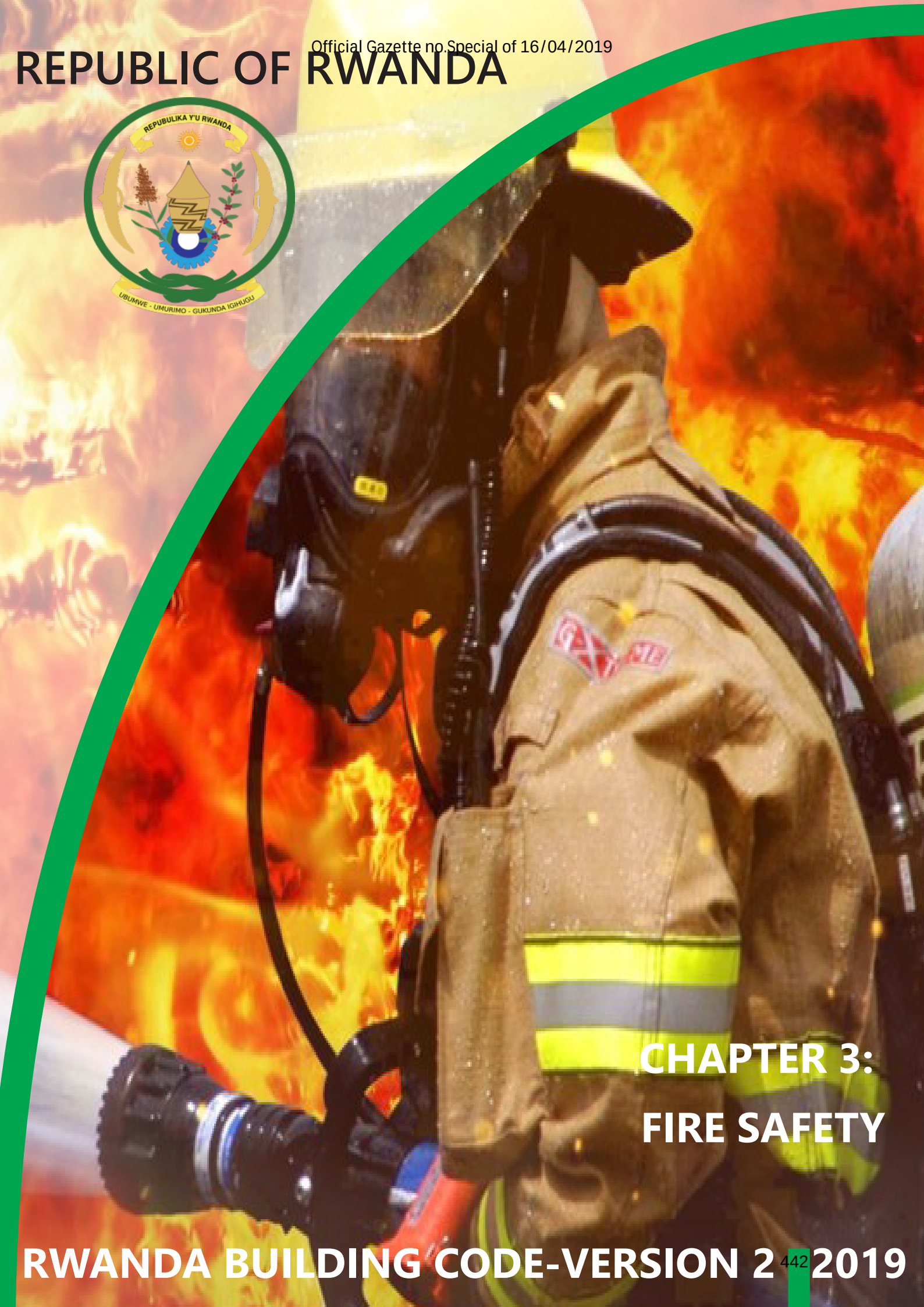

CHAPTER 3: FIRE SAFETY

RWANDA BUILDING CODE

Chapter Three: FIRE SAFETY

PART 8: FIRE & SMOKE PROTECTION FEATURES

PART 9: FIRE DETECTION & SUPPRESSION

PART 10: REQUIREMENTS FOR ACCESSIBILITY & EVACUATION

RWANDA BUILDING CODE

Chapter Three:
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SECTION 1: GENERAL FIRE PERFORMANCE
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SECTION 4: FIRE WALL, BARRIERS, PARTITIONS, ENCLOSURES & OPENINGS
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PART 8: FIRE & SMOKE PROTECTION FEATURES

SECTION 1: GENERAL FIRE PERFORMANCE

3.8.1.1. GENERAL REQUIREMENTS

3.8.1.1.1. Any building shall be designed, constructed and equipped in a way that, in case of fire, safe evacuation of occupants, minimization of the spread and intensity of fire and structural stability are catered for.

3.8.1.1.2. Adequate means of access to equipment for detecting, fighting, controlling and extinguishing fire shall be provided to minimize spread of smoke to reasonable greatest extent in accordance to the relevant parts of RS 186.

3.8.1.1.3. Where any element or component of a building is required to have a particular fire resistance such requirement, in respect of the materials or method of construction, shall have to be:

(i) Tested and sampled by an internationally accredited Laboratory or/and approved by the institution in charge of standards, and pass fire resistance requirements; or

(ii) Approved by the building control Authority as appropriate for the intended use.

3.8.1.1.4. Where non-combustibility of any element or component is required in terms of this Code such requirement shall be deemed to be satisfied where:

(i) Such element or component is proved to be made only of the relevant material;

(ii) When tested or approved by the institution in charge of standard, a representative specimen of such element or component has been shown to be non-combustible; and

(iii) An assessment, in writing, of such element or component has been made by the Authority and such element or component has been found to be suitable for the particular purpose.

3.8.1.1.5. In any building, not being a building classified as R-5, any architectural or decorative feature shall be constructed of combustible material only when such material has passed required tests conducted by an internationally accredited laboratory or approved by the institution in charge of standards.

3.8.1.1.6. The means of smoke ventilation from each storey shall be provided.

3.8.1.2. DIVISION AREA FOR FIRE -FIGHTING

3.8.1.2.1. Any building shall be divided into division of an area that complies with Table 3.8.1-1and such divisions shall be separated effectively from each other by division separating elements provided that:

(i) Where occupancy classified S-1, used for the storage of flammable liquids, forms part of any building, such part shall be a separate division and the area of such division shall be not more than 100m^2; and

(ii) Where storage of goods is to a height of more than 3m in any occupancy classified S-1 or S-2, an approved fixed installation of automatic fire extinguisher shall be provided.

Table 3.8.1-1: Maximum Division Area (m^2)

S/N	Occupancy	No Fixed Automatic Fire Extinguisher Installation	With Fixed Automatic Fire Extinguisher Installation	
			1 Storey	2 Storeys and over
1	*I-1, *I-2, 'I-3	1250	1250	1250
2	A-2, B-2, B-3, A-2, A-1, B-1	5000	No limit	10000
3	A-4, A-5, F-3, S-3, S-4	No limit	No limit	No limit
4	All other occupancies	2500	No limit	5000

* Maximum division area on any storey and all such divisions shall be interconnected.

3.8.1.3. ACCESS TO BUILDINGS FOR FIRE-FIGHTING AND RESCUE PURPOSES

3.8.1.3.1. Any building shall be provided with suitable access to its interior and exterior parts for the purposes of fire-fighting and rescue from any building by the fire services of the Authority except to any portion of any building which is to be used for the purposes of a strong room, record room, security vault, non-habitable computer room or specific technical areas to which the Authority approves.

3.8.1.3.2. Any escape door shall be clearly identified from the exterior of the building and the number of any storey shall be indicated inside any emergency route on any access door.

3.8.1.4. THEATRES AND INTENSIVE CARE UNITS BUILDINGS

3.8.1.4.1. Theatres (A-2), maternity delivery rooms or intensive care units (I-2) shall comply with the following requirements in conjunction with relevant parts of RS 186:

(i) Any lift used for the transport of patients shall be provided with an approved emergency power supply independent of the normal mains supply that is capable of operating for not less than 2 hours in the event of failure of the mains supply;

(ii) The walls, floor and ceiling separating such suite from any other suite or from any other part of the building shall have a fire resistance of not less than 2 hours; and

(iii) There shall not be fewer than two means of exit from such suite.

3.8.1.5. COMPARTMENTATION

3.8.1.5.1. The spread of fire within a building shall be restricted by sub-dividing it into compartments separated from one another by walls and floors of fire resisting construction complying with Tables: 3.8.2-6 and 3.8.2-8.

3.8.1.5.2. Compartmentation degree shall depend on:

(i) The use of fire load in the building, which affects the potential for fires and the severity of fires as well as the ease of evacuation;

(ii) The height of floor of the top storey which is an indication of the ease of evacuation and the ability of the fire and rescue service to intervene effectively; and

(iii) The availability of a sprinkler system which affects the growth rate of fire shall suppress it altogether.

3.8.1.6. SEATING ARRANGEMENTS BASED ON OCCUPANT LOAD IN AUDITORIA OR HALLS AND ON GRANDSTANDS

3.8.1.6.1. In any auditorium or hall or on any grandstand containing any seating:

(i) The seating and any aisles serving such seating shall be so arranged to allow unobstructed movement to the escape routes from such auditorium, half or grandstand; and

(ii) No seat shall be more than 21m from an escape door or an access door to an emergency route as measured along the route which a person occupying such seat may be expected to travel to arrive at such escape door or access door.

3.8.1.6.2. All seating on any grandstand or in any auditorium or hall not used for more than one purpose shall be fixed to the building; provided that seating need not be so fixed in any auditorium or hall, or a box therein, which accommodates not more than 25 persons.

3.8.1.6.3. Where individual seats are not provided every 450mm of seating shall be deemed to be a seat.

3.8.1.6.4. The clearance between rows of seats in any auditorium or hall shall be not less than:

(i) 0.3m where any person is not required to pass more than 14 seats to leave the row;

(ii) 0.4m where any person is required to pass more than 14 seats but not more than 24 seats to leave the row; or

(iii) 0.5m where any person is required to pass more than 24 seats to leave the row.

3.8.1.6.5. The clearance between rows of seats in outdoor grandstands, where backrests are provided to such seats, shall be not less than:

(i) 0.3m where any person is required to pass not more than 20 seats to leave the row;

(ii) 0.4m where any person is required to pass more than 20 seats but not more than 40 seats to leave the row;

(iii) 0.5m where any person is required to pass more than 40 seats to leave the row; and

(iv) Where backrests are not so provided, or on terraced seating, the minimum distance from the front edge of any seat to the front edge of the seat immediately in front of or behind such seat shall be not less than 0.7m.

3.8.1.6.6. Any aisle in any auditorium, hall or grandstand shall have a dear width of not less than 1.1m or such greater width as contemplated for an emergency route for the population served, and the surface of the floor and any steps of such aisle shall be rendered suitably slip-resistant and shall at all times be maintained in such slip-resistant condition.

3.8.1.6.7. Any cross-aisle shall discharge at both ends directly to an emergency route.

3.8.1.6.8. The gradient of such aisle which is not level shall not exceed 1 in 8 and any stepped aisle shall not exceed an overall gradient of 1 in 3.

3.8.1.6.9. Steps along any such aisle shall be the full width of such aisle and shall be illuminated to a level of not less than 2 lux at tread level when normal lighting has been lowered and shall have uniform tread widths and risers so designed as to reduce the likelihood of any person stumbling.

3.8.1.6.10. Any exit door from any auditorium shall be provided with approved panic bolts, and at no time during occupancy of such auditorium or hall by the public shall such door be locked, obscured, obstructed, covered or hidden and shall comply with Table 3.10.2-4.

3.8.1.6.11. For determining the exits requirement, the number of persons within any floor area or the occupant load should be based on the actual number of occupants, but in no case less than that specified in Table 1 in RS 186-5.

3.8.1.6.12. Any floor covering in any auditorium or hall shall be securely fixed and maintained in a safe condition.

3.8.1.6.13. An approved standby system for emergency lighting independent of the normal mains supply shall be provided in any theatre complex or any individual auditorium, hall or grandstand where the total number of seats exceeds 240 or the floor area exceeds 240m2, in order to afford a level of illumination of not less than 2 lux to enable persons to leave all parts of such theatre complex, auditorium, hall or grandstand in the event of failure of the normal mains supply.

3.8.1.6.14. The power supply to such emergency lighting shall be safe-guarded against the effects of a fire for at least 30 minutes.

3.8.1.7. STAGE AND BACKSTAGE AREAS

3.8.1.7.1. Any area separated from any dressing room, auditorium, workshops, stores or any other area within the occupancy, by walls and floors shall have a fire resistance of not less than 2 hours, and any opening, other than the proscenium opening, in such wall or floor shall be protected by a fire shutter.

3.8.1.7.2. No dressing room shall be at any level lower than the first basement storey.

3.8.1.7.3. Any proscenium opening shall be protected by a fire curtain which shall be:

(i) Constructed to slide freely in non-combustible guide rails on both sides of the proscenium opening;

(ii) So arranged that when fully closed it overlaps the proscenium wall, on the stage side, by not less than 0.45m at each side of such opening and 0.6m at the top and is closed at the bottom onto the stage floor which of combustible material, shall be not more than 38mm thick over a non-combustible slab or wall;

(iii) So arranged that in the case of a fire it will descend automatically and close such opening;

(iv) So arranged and controlled that it can descend completely within 30 seconds and be so regulated that for the last 2m of its descent it does not travel faster than 0.5m/s; and

(v) Capable of being both manually and remotely operated; provided that in the case of a stage in any school or church hall or other similar place seating not more than 300 persons and which is used solely for the presentation of amateur productions, a heavy woollen or non-combustible fiber cloth curtain may be-substituted for such fire curtain.

3.8.1.7.4. In any area, the following fire protection equipment shall be provided with:

(i) An automatic sprinkler system and an automatic drencher system to the stage side of the fire curtain so designed as to give adequate protection in the event of a fire;

(ii) At the highest point of the roof over such area, an acceptable automatic roof ventilation system the effective aggregate area of opening of which shall be not less than 10% of such area and which shall also be capable of being manually operated;

(iii) A direct communication with the local authority's fire services; and

(iv) Manual alarms in the backstage area in suitable and easily accessible positions.

3.8.1.7.5. Any dressing room area shall have direct access to an emergency route.

3.8.1.8. AIR-CONDITIONING AND VENTILATION SYSTEMS

3.8.1.8.1. Any air-conditioning system or artificial ventilation system in any building shall be so designed to prevent the distribution of products of combustion in the event of a fire in such building.

3.8.1.8.2. Any-air shaft or duct used for air-conditioning or artificial ventilation, including any internal or external insulation thereto and any flexible joint, shall be constructed of non-combustible material or material which has been favorably evaluated by the authority as being suitable for such shaft, duct, joint or insulation provided that:

(i) Approved combustible flexible connections may be used where the length of such connection does not exceed 1.5m and such connection does not pass through any wall or floor which is required to have a specified fire resistance; and

(ii) Approved combustible flexible joints not more than 250mm in length may be used in any plant room where such plant room is protected by a smoke detection system.

3.8.1.8.3. A fire damper shall comply with ISO 10294-1 and shall be provided in any air duct in any position where such duct passes through any required division or occupancy separating element or any element required for the enclosure of an emergency route or passes into any duct.

3.8.1.8.4. Any such fire damper shall:

(i) Close automatically upon the operation of a suitably located sensing device actuated by an abnormal rise in the temperature or by the presence of smoke or combustion gases in the air duct;

(ii) Be provided with adequate access, the position of which shall be clearly marked, for inspection, maintenance and resetting of the mechanism;

(iii) Be so installed as to remain in position at the protected opening even if the air; duct distorts during a fire; and

(iv) Be provided with an overriding fusible link.

3.8.1.8.5. The supports of any plenum shall be non-combustible.

3.8.1.8.6. No plenum system shall be used for storage or for the accommodation of people.

3.8.1.9. The floor of any occupancy classified S-4 shall be of non-combustible material and shall be not less than 25mm lower than the threshold of any door leading to any adjoining occupancy.

3.8.1.10. NO SMOKING SIGNS

3.8.1.10.1. An approved sign shall be prominently displayed in suitable positions in any division, occupancy, room or any other part of a building where flammable substances are dealt with, used or stored and on the outside of any door leading thereto. Safety signs and marking used shall comply with requirements of ISO 3864.

COMMENTARY:

For the purpose of fire safety regulations in this Code, the classification of buildings based on occupancy shall be matched to the classifications in RS 186-1

as in the specified in Table: 3.8.1-2 below: For classes MEM; MIX and MISC which do not have their equivalences in RS 186: Part 1 to 5 figures from the nearest classes will be applied.

Table: 3.8.1-2: Occupancy Classification

S/N	CLASSIFICATION	GROUPING AS PER CHAPTER 1 OF THIS CODE	GROUPING AS PER RS 168-1
1	ASSEMBLY	A	D
2	BUSINESS (COMMERCIAL)	B	E
3	EDUCATIONAL	E	B
4	FACTORY AND INDUSTRIAL	F	G
5	INSTITUTIONAL	I	-
6	MERCANTILE	M	F
7	RESIDENTIAL	R	A
8	STORAGE	S	H
9	MEMORIAL	MEM	-
10	MIXED USE	MIX	-
11	MISCELLANEOUS	MISC	-

SECTION 2: FIRE RESISTANCE & RATING

3.8.2.1. GENERAL REQUIREMENTS

3.8.2.1.1. Each building or construction element shall be constructed in such way that it can limit the spread of the fire as per provisions of ISO/TS 5658-1 during fire accidents, protect the building property from damage and easy of escape occupants from the fire accidents and shall comply with RS 186-1 and RS 186-2.

3.8.2.1.2. The fire-resistance rating of building elements, components or assemblies shall be determined in accordance with the test procedures set in accordance with Part 8, Section 3 of this Code.

3.8.2.1.3. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the building element, component or assembly, enough data in accordance with international standards shall be made available to the building official to show that the required fire-resistance rating is not reduced. Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements, components or assemblies shall not reduce the required fire-resistance-rating and shall comply with RS 186-1 and RS 186-2.

Exception: In determining the fire-resistance rating of exterior bearing walls, temperature rise and ignition of cotton waste due to passage of flame or gases is required only for a period of time corresponding to the required fire-resistance rating of an exterior non-bearing wall with the same fire separation distance, and in a building of the same group.

3.8.2.1.4. When the fire-resistance rating determined in accordance with this exception exceeds the fire exposure time period, water pressure and application duration criteria for the hose stream test shall be based upon the fire-resistance rating determined in accordance with this exception.

3.8.2.2. NON-COMBUSTIBLE BUILDING MATERIALS

3.8.2.2.1. The materials listed in Table 3.8.2-1 below are deemed to satisfy the requirements for non-combustibility as prescribed in ISO 1182 singly or in combination with each other. Any addition of organic or other combustible material may render the listed material combustible in accordance with ISO 10295-1 and materials not listed are presumed to be combustible except where proved otherwise when tested in accordance with Part 8, Section 3 of this Code.

3.8.2.2.2. The floor of any occupancy classified S-4 shall be of non-combustible material and shall be not less than 25mm lower than the threshold of any door leading to any adjoining occupancy.

Table: 3.8.2-1: Non-Combustible Building Materials

S/N	Materials
1	Fibre-cement
2	Fibre-cement products with less than 7.5 % combustible additives
3	Brass
4	Bricks (burnt clay, lime/sand, cement/sand)
5	Cement (Portland and blast furnace
6	Clay (burnt or unburnt)
7	Concrete
8	Furnace slag
9	Glass (solid)
10	Glass fibers (spun, woven or wool, with less than 5% resin content)
11	Gypsum (with less than 7.5% paper or other combustibles)
12	Lime
13	Metals (other than the alkaline metals)
14	Mineral wool (with less than 5% resin content)
15	Perlite
16	Porcelain
17	Pumice
18	Sand
19	Steel (cast or rolled)
20	Stone, natural
21	Vermiculite
22	Mortar (lime, cement, gypsum)
23	Aluminium (extrusions or castings)

(i) The metals listed in Table 3.8.2-1 above may only be considered to be non-combustible when they are in solid form and not when in the form of a powder or shavings; and

(ii) The percentages given are by mass.

3.8.2.2.3. Combustible aggregates are permitted in gypsum and Portland cement concrete mixtures for fire-resistance-rated construction. Any component material or admixture is permitted in assemblies if the resulting tested assembly meets the fire-resistance test requirements of this code.

3.8.2.2.4. Insulating materials such as fiberglass, mineral wool, cellulose, polyurethane foam and polystyrene shall be used by considering their performances and specific flame spread index or a smoke-developed index in accordance with ISO 834 and ISO 29771. Any material that is subject to an increase in flame spread index or smoke-developed index beyond the limits herein established through the effects of age, moisture or other atmospheric conditions shall not be permitted.

3.8.2.2.5. Any insulation, insulating panel or lining used as a thermal insulation system under an external covering as part of a roof or wall assembly tested in accordance with ISO 1182: and found to be combustible, shall be acceptable, when classified in terms of ISO 13785, its use and application shall also be acceptable.

3.8.2.2.6. The fire resistance rating of an occupancy separating element shall be in accordance with the Table 3.8.2-2 and the value to be used shall be appropriate to the occupancy class on each side of the separating element.

3.8.2.2.7. In the case of a division separating element, the requirements of these regulations shall be deemed satisfied where the fire resistance rating is in accordance with the Table 3.8.2-3.

3.8.2.2.8. Any structural element or component that will directly support or adjoin any separating element shall be of the same fire resistance rating as the supporting or adjoining separating element.

3.8.2.3. FIRE RESISTANCE RATING FOR NON-COMBUSTIBLE ROOF

3.8.2.3.1. The roof assembly in any building shall have a fire resistance rating of not less than 30 minutes and where the roof assembly exceeds 10m in height, it shall be constructed with non-combustible materials.

3.8.2.3.2. Where any approved combustible materials are used as a roof covering of a building, the distance between the building and its site boundary shall not be less than 4.5m.

3.8.2.3.3. In the case of any building exceeding 10m in height or that has a roof area exceeding 500m^2, the roof covering material shall be constructed with reinforced concrete or other approved non-combustible materials.

3.8.2.3.4. A suspended ceiling and the supporting members of a building shall be of non-combustible materials.

3.8.2.3.5. A fitted floor covering in any building shall comply with the requirements in approved Standards and the committee may require proof of compliance by a test to be undertaken by a competent person or testing facility.

3.8.2.4. FIRE-RESISTANCE-RATED GLAZING

3.8.2.4.1. Fire-resistance-rated glazing, when tested and complying with the requirements of this code shall be permitted. Fire-resistance-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and the identifier which shall be permanently affixed to the glazing.

3.8.2.5. FIRE RESISTANCE RATINGS FOR FLOORS

3.8.2.5.1. A floor of any building shall be of adequate strength to support its own weight and all imposed loads on it and have appropriate fire resistance rating applicable to its use.

3.8.2.5.2. Floor shall be built of non-combustible materials so as to get a required fire resistance rating.

3.8.2.6. FIRE RESISTANCE RATINGS FOR WALLS

3.8.2.6.1. Fire-resistant joint systems shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gases and shall comply with RS 186-1 and RS 186-2.

3.8.2.6.2. A wall, floor or ceiling of an emergency route in any building shall have a fire resistance rating of not less than 2 hours.

3.8.2.6.3. A wall in a building that separates one tenant from another shall have a fire resistance rating of not less than 1 hour. The exterior walls facing the reduced width shall have a minimum fire resistance rating of 3 hours.

3.8.2.6.4. A minimum fire resistance rating of one hour is assigned to a means of passage from one other.

3.8.2.1.4. The fire resistance rating of the partition wall must not be less than one hour in any building reserved for hospital or disable people. One or more ongoing fire resistance walls separating each allocation of a building shall have a fire resistance rating not less than 2 hours and shall comply with RS 186-1 and RS 186-2.

3.8.2.6.5. The fire resistance of external walls shall be rated with opening protection and shall have a fire resistance rating according to Table 1 in RS 186-2

3.8.2.6.6. Where an external wall of any building does not contain a window or other opening, the wall shall have a fire resistance rated and the wall may be erected without any distance restriction from any lateral boundary of the site, or from any other building on the same site constructed of non-combustible material. Except where the external wall faces a public open space, where all windows or openings in the wall are protected with fire shutters.

3.8.2.6.7. The fire resistance rating of a separating element shall be in accordance with the Table 3.8.2-2 below and the value to be used shall be appropriate to the occupancy class.

Table 3.8.2-2: Fire Resistance Rating of Occupancy Separating Elements.

S/N	Occupancy Separating Elements	Fire Resistance Rating(Hours)
1	For all building occupancies other than those specified below	1
2	B-1, F-1, F-4, I-1, S-3, S-4	2
3	S-1	4

3.8.2.6.8. In the case of a division separating element, the fire resistance rating shall be in accordance with the Table 3.8.2-3below.

Table 3.8.2-3: Fire Resistance Rating of Occupancy Division Elements

S/N	Occupancy Division Element	Fire Resistance Rating (Hours)
1	For all building occupancies other than those specified below	2
2	B-3	1.5
3	B-3, R-4	1
4	S-1	4

3.8.2.7. FIRE RESISTANCE RATINGS OF COLUMNS

3.8.2.7.1. The fire resistance ratings of column shall depend on size of the side and the type of the element. Table 3.8.2-4 below shows concrete masonry columns and their corresponding fire resistance ratings.

Table 3.8.2-4: Fire Resistance Ratings and Concrete Column Size

S/N	Fire Resistance Rating (Hours)	Minimum Dimension for Column Size (cm)
1	1	20.32
2	2	25.4
3	3	30.48
4	4	35.56

3.8.2.8. FIRE RESISTANCE RATINGS OF MASONRY SYSTEMS

3.8.2.8.1. The fire resistance rating of masonry walls made from clay bricks is proportional to the increase of thickness. Table 3.8.2-5 below shows bricks thicknesses and their corresponding fire resistance ratings:

Table 3.8.2-5: Fire Resistance Rating of Clay Masonry Wall

Material Type	Minimum Required Thickness			
	1 hour	2hour	3 hour	4 hour
Solid brick of clay (cm)	7	9.7	12.5	15.3
Hollow brick or tile of clay unfilled (cm)	5.8	8.6	11	12.7
Hollow brick or tile of clay filled with sand, pea gravel, crushed stones (cm)	7.6	11.2	14	16.8

3.8.2.9. PRESUMED FIRE RESISTANCE OF BUILDING MATERIALS AND COMPONENTS

3.8.2.9.1. The building materials and components contemplated in Tables 3.8.2-1 to 3.8.2-3 of this section shall be deemed to satisfy the performance requirements, under fire conditions, provided that such materials and components comply with the relevant detailed descriptions given in such tables.

3.8.2.9.2. Any monolithic unreinforced concrete element or any concrete masonry constructed of solid concrete masonry units in accordance with the requirements contained in ISO 834-1 shall be considered to be a solid concrete unit and shall be deemed to have the fire resistance given in Table 3.8.2-4.

3.8.2.9.3. Only such building materials, components, and methods of construction for which sufficient test data is available are listed in Tables 3.8.2-1 to 3.8.2-4; the tables will, where necessary, be updated when new evidence on performance becomes available. The fact that a material or method of construction is not mentioned in this regulation should not be construed to mean that such material or method cannot be used but it shall mean that the fire resistance shall be ascertained by test or be assessed to be suitable for a particular application.

3.8.2.9.4. Where concrete structural elements and components are constructed in accordance with the relevant requirements contained in ISO/TR 15655, such elements and components may be presumed to have the fire resistance assumed for the purposes of the required design.

Table 3.8.2-6: Walls and Partitions

S/N	Construction	Minimum Thickness (mm) (Excluding Plaster) for Period				
		6 hours	**4 hours**	**2 hours**	**1 hour**	**½ hour**
1	Solid construction:- bonded, Stone, and coursed; bricks of clay, concrete or sand lime: No plaster	216	216*	216†	102	102
2	Plastered at least 13mm thick on each side			102	64	64
3	Concrete blocks: Class 1 Aggregate: No plaster			102	76	64
4	Class 2 Aggregate: No plaster				102	76
5	Gypsum blocks: No plaster			102	76	52
6	Plastered at least 13mm thick on each side			102	76	51
7	Wood wool slabs: Plastered at least 13mm thick on each side			76	51	51
8	Plastered at least 13mm thick on each side			76	51	51
9	Reinforced concrete: Aggregate with reinforcement (in two layers in walls over 127mm in thickness) in two different spaced not further apart than 153mm centers, the volume of which is not less than 0.2 per cent of the volume of the concrete with minimum cover of 25mm	229	178	102	76	76
10	Plaster board: Supported at top and bottom edges in steel channels and plastered on each side at least 16mm thickness with gypsum plaster				19	
11	Glass bricks: In panels not exceeding 4sq.m. in area with expansion joints not less than 2.5mm per meter width of the panel at each side of the panel, and not less than 2.5mm per meter of the height of the panel at the top of the panel				102	

* Where plastered at least 25mm thick on each side with gypsum/vermiculite plaster not leaner than 1:2 and where the wall does not exceed 3 meters either in height or length, the thickness for this period may be 0.1m.

† Where plastered at least 13mm thick on each side and where the wall does not exceed 3 meters either in height or length, the thickness for this period may be 0.1m.

Table 3.8.2-7: Hollow Stud Construction of Steel and Timber

S/N	Construction	Minimum Thickness (mm) on each Face for Period			
		4 hours	2 hours	1 hour	1/2 hour
1	STEEL OR TIMBER STUDDING:-Plaster on metal or timber lathing: Portland cement plaster, Portland cement lime plaster or gypsum plaster			19	13
2	Plaster board with or without gypsum plaster: 10mm thick plaster board on each side				5 (Neat single coat)
3	10mm thick perforated plaster board on each side			13	
4	Two 10mm thick plaster boards on each side			Nil	
5	13mm thick plaster board on each side			10	
6	19mm thick plaster board on each side			Nil	

Table 3.8.2-8: Floors

S/N	Construction	Minimum Thickness (mm) For Period				
		4 hours	2 hours	1 hour	1/2 hour	Periods specified for small houses
1	Concrete cover to reinforcement	25	13	13	13	
2	Concrete cover on bottom of joist	76	25	13	13	
3	Hollow block floor construction : (Including floors constructed of precast concrete units of box-section or 1-section): Aggregate	127	89	76	63	

	thickness of non-combustible material (excluding ceiling fishes (if any)					
4	Concrete cover to reinforcement	25	13	13	13	
5	Solid reinforced concrete construction:-(Including flat slab construction and floors constructed on pre-cast inverted "U" channel or T-sections, without a ceiling or soffit): Thickness of concrete	152		102	89	
6	Filler joist construction:- Thickness of concrete	152	127	76	89	
7	Structural timber construction:- (a) Plan edge boarding on timber joists not less than 38mm wide with ceiling of: (i) Timber lath and plaster- Thickness of plaster					16
8	(ii) Timber lath and plaster with plaster of minimum thickness of 15mm covered on underside with plaster, board of thickness			13		
9	(iii) Metal lath and plaster- Thickness of plaster			19		
10	(iv) One layer of plaster-board of thickness					13
11	(v) One layer of plaster-board of minimum thickness of, 10mm finished with gypsum plaster of thickness					13
12	(vi) One layer of plaster-board of minimum thickness of 13mm finished with gypsum plaster of thickness				13	
13	(vii) Two layers of plaster-					19

	board of total thickness					
14	(viii) One layer of insulating board of minimum thickness of 13mm finished with gypsum plaster of thickness					13
15	(ix) Wood-wool slab 25mm thick finished with gypsum plaster of thickness				5	
16	(b) Tongued and grooved boarding not less than 19mm (nominal) thickness on timber joists not less than 38mm wide with ceiling of: (i) Timber lath and plaster- Thickness of plaster				10 10	16
17	ii)Timber lath and plaster with plaster of minimum thickness of 19mm covered on underside with plaster-board of thickness				5 22	10
18	(iii) One layer of plaster-board of minimum thickness of 13mm finished with gypsum plaster of thickness.				5	
19	(iv) Two layers of plaster-board of total thickness					5
20	(v) Wood-wool slab 25mm thick finished with gypsum plaster of thickness				16 16	
21	(c) Tongued and grooved boarding not less than 25mm (nominal) thickness on timber joists not less than 178mm deep by 51mm wide with ceiling of:				13	10
22	(i) Metal lath and plaster thickness of plaster				5	
	(ii) One layer of plaster-board of thickness				19	
23	(iii) One layer of plaster-board of minimum thickness				13	13

	of 13mm finished with gypsum plaster of thickness					
24	(iv) Two layers of plaster board of total thickness (v) One layer of insulating board of thickness... (vi) One layer of insulating board of minimum thickness of 13mm finished with gypsum plaster of thickness				5	

Table 3.8.2-9: Steel Columns and Beams

S/N	Construction	Minimum Thickness of Protection (mm) for Period			
		4 hours	2 hours	1 hour	½ hour
1	**Solid protection:** Columns: Reinforced concrete	64	51	25	25
2	Solid bricks of burnt clay of sand lime Solid blocks reinforced in every horizontal joint	76	51	51	51
3	1. Gypsum blocks	51	51	51	51
4	2. Foamed slag or pumice concrete	64	51	51	51
5	Beams: Reinforced concrete	64	51	25	25
6	**Hollowed protection:** Columns; Solid bricks or burnt clay or sand lime reinforced in every horizontal joint	114	76	51	51
7	Solid bricks of foamed slag or pumice concrete or gypsum reinforced in every horizontal joint	76	51	51	51
8	Portland cement plaster or Portland cement-lime plaster on metal lathing				19
9	Portland cement plaster or Portland cement-lime plasters on metal lathing with reinforcement over rendering coat			25	
10	Gypsum plaster on metal lathing			22	16
11	Gypsum plaster on 10mm gypsum plaster boards with No. 16 S.W.G. wire binding at 102mm pitch			13	

12	Two layers of metal lathing plastered With gypsum plaster on each layer	19			
13	Precast concrete consisting of 4 volumes of vermiculite to 1 volume of Portland cement, reinforced with expanded metal, wire mesh of with No. 15 S.W.G. wire binding at 102mm pitch			25	
14	Portland cement plaster or Portland cement-lime plaster on metal lathing				19
15	Gypsum plaster on metal lathing				S-60
16	Precast concrete consisting of 4 volumes of vermiculite mesh or with No. 16 S.W.G. wire binding at 102mm pitch		22 13	25 16 25	5 (neat single coat)

The thickness of protection or any projecting cleat, projecting rivet head and the like need not exceed 25mm. The thickness of protection on the super surface of the upper flange of an internal mean, and on any projecting cleat, projecting rivet head and the like need not exceed 25mm.

Table 3.8.2-10: Reinforced Concrete Columns and Beams

Construction and Materials	**Minimum Thickness of Protection (mm) for Period**			
	4 hours	**2 hours**	**1 hour**	**½ hour**
Reinforced concrete columns	450	300	203	152
	300	225		
Reinforced concrete columns with light 51mm mesh reinforcement placed centrally in the concrete cover to longitudinal reinforcement	**Minimum Concrete to Reinforcement (mm) for Period**			
	4 hours	**2 hours**	**1 hour**	**½ hour**
Reinforcement concrete beams	64	51	38	25

NOTE: This Table is not to be applied in the case of post- or pre-stressed concrete. Special approval of The Authority will be required in the case of this special form of construction.

SECTION 3: FIRE RESISTANCE TESTING

3.8.3.1. GENERAL REQUIREMENTS

3.8.3.1.1. The fire-resistance ratings of structural members and assemblies shall comply with this section and the requirements for the type of construction.

3.8.3.1.2. The fire-resistance ratings shall not be less than the ratings required for the fire-resistance-rated assemblies supported by the structural members.

3.8.3.1.3. Structural members of any building shall be constructed so that they shall be capable of resisting to the effect of fire and fire resistance rated in accordance with an approved standard.

3.8.3.1.4. In this code a non-combustible condition as it relates to a structural member shall be constructed as the member being composed entirely of a non-combustible material excluding the lining, facing, or any other finishes.

3.8.3.1.5. The specimen shall have the same properties as the structural element to be tested and its components like grilles, light fittings, wirings, mechanical joints, and the same mechanical supports, size and similar edge have to be considered.

3.8.3.1.6. The fire resistance testing of structural materials shall be determined by considering material structural properties, type of material, site characteristic parameters, dimensions change due to temperature.

3.8.3.1.7. The visual fire resistance testing shall be in compliance with the thickness, the loading of exposed member and the structural surface conditions**.**

3.8.3.2. FIRE TESTING

3.8.3.2.1. Fire testing of materials, components and elements used in buildings shall comply with ISO/TR 10295-3.

3.8.3.2.2. The fire resistance rating of the non-symmetrical wall joint shall be tested with both faces exposed under furnace, then it is obtained as the shortest duration from the two tests.

3.8.3.2.3. When evidence is provided to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side.

3.8.3.2.4. The fire resistance rating of exterior walls having a horizontal fire separation distance greater than 1.5m should be tested for the interior fire exposure only.

3.8.3.2.5. Devices, systems or materials that have not been tested as part of fire resistance rated assembly are incorporated into assembly, testing is necessary to show that the required fire resistance rating is not reduced.

3.8.3.2.6. After 30 minutes of standard fire test, exit doors and passage ways shall have a maximum of 2500c above the ambient temperature.

3.8.3.2.7. A material shall have a time that it will withstand the standard exposure of fire and this time is determined by the standard fire tests of material, elements or structure.

3.8.3.2.8. The fire resistance of structural steel beams and girders protected with in tumescent or mastic fire-resistant coatings shall be determined based on fire-resistance tests.

3.8.3.3. FIRE RESISTANCE TESTING OF COLUMNS

3.8.3.3.1. The fire resistance rating of structural steel columns is carried out by exposing all sides to fire and considering the standard allowable load to be supported in accordance with ISO 834-11.

3.8.3.3.2. A structural steel column is resistance rated if the measured temperature of exposed sides does not exceed the specified temperature. Accordance with ISO 834-7**,** the test shall be based on:

(i) The element thickness;
(ii) The type of protection provided; and
(iii) The surface under furnace.

3.8.3.4. FIRE RESISTANCE TESTING FOR STRUCTURAL WALLS

3.8.3.4.1. A structural wall shall be plastered on both sides in order to increase its fire resistance. Fire resistance test for structural walls shall comply with ISO/TS 5658-1and ISO 10295-2, ISO 834-5 and ISO 834-1.

3.8.3.4.2. Interior walls and partitions of non-symmetrical construction shall be tested with both faces to the furnace and the assigned fire resistance rating shall be the shortest duration obtained from the tests conducted in compliance with ISO 834-1, ISO/TR 834-2, ISO/TR 834-3, and ISO 834-5.

3.8.3.5. FIRE RESISTANCE TESTING FOR BEAMS AND GIRDERS

3.8.3.5.1. The fire resistance of timber beams and columns with not less than 152mm is determined by the number of sides exposed to fire**.**

3.8.3.5.2. The fire resistance rating of structural members shall be determined by the fire test procedures and the fire endurance shall not be applied to beams smaller than the tested specimen. The test is considered if the maximum temperature is equivalent to the designed beam or girder temperature and shall comply with ISO 834-6.

3.8.3.6. FIRE RESISTANCE TESTING FOR ROOFS AND FLOORS

3.8.3.6.1. The test shall be applied to floors and roofs systems without attached ceilings and this requires the exposure of the fire to the specimen under test**.**

SECTION 4: FIRE WALL, BARRIERS, PARTITIONS, ENCLOSURES & OPENINGS

3.8.4.1. FIRE WALLS AND PARTITIONS

3.8.4.1.1. A fire wall shall be considered as a wall of enough fire resistance, durability and stability to endure the effects of an uncontrolled fire exposure, which should cause the collapse of the structural framework on either side.

3.8.4.1.2. Any partition wall where the occupancy is classified R-1; R-3 or R-4 shall have a fire resistance of not less than 30 minutes.

3.8.4.1.3. A wall in a building for any occupancy classified I-3, I-1 or I-2 shall be of materials permitted by the building type of construction and shall have a fire resistance of not less than 60 minutes and any such wall in any occupancy classified B-3, R-3, R-4 or R-5 shall have a fire resistance of not less than 20 minutes.

3.8.4.1.4. For any building classified R-4 or R-5:

(i) Any wall between any garage and any habitable room shall have the same fire resistance as that specified for the internal walls of such building;

(ii) Any door between such garage and such room shall be a solid timber or solid timber core door not less than 40mm in thickness; and

(iii) Any roof space shall be divided by the vertical extension of such wall to the underside of the roof covering.

3.8.4.1.5. Any partition walls or partitions put up on any storey above the third storey of any building shall be non-combustible or shall not contribute a fire load of more than 5kg/m^2 of floor area in a division if wall finishes comply with the requirements of interior finishes.

3.8.4.1.6. Fire partitions shall expand from the top of the foundation or floor/ceiling assembly below to the bottom of the floor or roof covering, slab or deck above or to the fire-resistance-rated floor/ceiling or roof/ceiling assembly above and shall be securely attached thereto.

3.8.4.1.7. The Authority may permit the use of combustible material in a suspended floor of a building if it is designed or constructed to accommodate two or more dwelling units and does not exceed two storeys in height, or in a detached dwelling house where such a floor shall be directly above ground level or above a non-combustible floor slab.

3.8.4.1.8. Fire walls shall be designed and built with materials that have met the requirements of ISO 834-11 and specific required instructions for fire-endurance tests, which include placing a sample of a firewall in a furnace and heating it to a certain temperature for a specified length of time, shall be determined accordingly.

3.8.4.1.9. The performance evaluation for fire partition shall be done in accordance with ISO 7892 that specifies the requirements for vertical building elements, Impact resistance tests, impact bodies and general test procedures.

3.8.4.1.10. Fire walls shall be inspected and accepted at the time of construction in accordance with ISO 1182 for specific method of test for determining the non-combustibility performance, under specified conditions, of homogeneous products and substantial components of non-homogeneous products.

3.8.4.2. FIRE BARRIERS

3.8.4.2.11. All building construction shall take account of the use of fire barriers to protect the occupants in the event of a fire emergency and to avoid the open channel of fire and products of combustion throughout enclosed spaces or openings.

3.8.4.2.12. Fire barriers shall be of materials permitted by the building type of construction.

3.8.4.2.13. Shaft enclosures for fire barriers shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more, and not less than 1 hour where connecting less than four stories.

3.8.4.2.14. The fire-resistance rating of the fire barrier separating building areas from an exit hall comply with Section about horizontal exits.

3.8.4.2.15. Fire barriers shall embody many features that must be kept intact for the barrier to perform its intended function of protection.

3.8.4.2.16. A fire barrier shall subdivide a floor or an area and shall be erected to extend from the floor to the underside of the floor or roof above.

3.8.4.2.17. Fire barrier shall be continuous through all concealed spaces, such as those found above a ceiling, including interstitial spaces.

3.8.4.2.18. The specific requirements for fire resistance testing which are unique to the elements of construction described as separating non-load bearing elements both horizontal and vertical as well as fire barriers shall be evaluated in accordance with the detailed and general requirements contained in ISO 834-1

3.8.4.3. FIRE SHAFT AND VERTICAL ENCLOSURES

3.8.4.3.19. The walls of an internal service shaft shall have a fire resistance of not less than the requirements for structural stability given in table showing the Stability of structural elements or components, subject to a maximum requirement of 2 hours.

3.8.4.3.20. In the case a vertical service shaft provided in a building is attached to the floors it serves by a separating element, and such shaft does not contain any combustible material, it shall be fire-stopped at the level of every second storey above the bottom of such shaft and shall have a fire resistance of not less than the requirements for structural stability, subject to a maximum requirement of 2 hours.

3.8.4.3.21. When such a shaft is so provided and it contains any combustible material, it shall be fire stopped at the level of every storey above the bottom of such shaft.

3.8.4.3.22. Where a vertical service shaft is used for ventilation or contains non-combustible plumbing or drainage services or is a non-combustible rubbish chute, no fire stop shall be required within such shaft, and the doors to such shafts shall be self-closing fire doors as shown in Table 3.8.4-1.

3.8.4.3.23. Where a service penetrates a separating element, such separating element shall be fire stopped with a suitable system of the same rating of the element it passes through. Such system shall have a test report prepared in accordance with the requirements of ISO/TR 10295-3 and shall be installed in accordance with the provisions relating thereto.

3.8.4.3.24. The proposed system should have a technical report for the intended application, installation instructions and certification on completion.

3.8.4.3.25. In all places the opening is protected by approved power-operated automatic shutters at every penetrated floor. The shutters shall be of non-combustible construction and have a fire-resistance rating of not less than 1.5 hours.

3.8.4.3.26. A shaft and Non-combustible pipe, tube and channel penetrating a shaft wall shall have approved fire barriers installed on the penetrating pipe, tube and conduit and the air ducts passing throughout a floor shall be enclosed therein.

3.8.4.3.27. A shaft enclosed space is not required for approved masonry chimneys where annular space is Fire blocked at each floor level and is also not required for penetrations by ducts protected.

3.8.4.3.28. The evaluation shall be done in accordance with ISO 834 for Fire Resistance Test-Elements of a Building.

3.8.4.4. OPENING

3.8.4.4.29. Any opening within a separation wall shall be protected and shall be provided with a suitable fire door or fire shutter, window assemblies and fire dampers, which shall be fitted with an approved self-closing or automatic closing device.

3.8.4.4.30. In any building, except a building classified R-5 any opening, including an opening occupied by a stairway or escalator not forming part of an escape route, shall not connect more than:

(i) Two storeys if such building is not protected by sprinkler system; or
(ii) Four storeys if such building is protected by sprinkler system.

3.8.4.4.31. For any opening within external wall of any division that is less than 1m measured horizontally or vertically from an opening in another division, a 500mm projection from such wall shall be constructed between such openings.

3.8.4.4.32. Where there is an opening in any wall required to have a fire resistance of one hour or more, such opening shall be provided with a fire door or fire shutter of the class given in column 3 of Table: 3.8.4-1, provided that this requirement shall not apply in the case of any service shaft that is fire-stopped at every floor level.

3.8.4.4.33. Fire doors to service shafts and service rooms do not need to be fitted with self-closing devices, but shall be fitted with locks that provide restricted access.

Table: 3.8.4-1: Class of Fire Doors or Fire Shutters.

S/N	Type of Wall	Required Minimum Fire Resistance of Wall Minutes	Class of Fire Door or Fire Shutter
1	Occupancy separation element	60	A
2		120	B
3	Occupancy separation- plant rooms or other ancillary accommodation	120	C
4		60	A
5	Divisional separation	60	A
6		120	D
7	Emergency Route	120	B
8	Protected Corridor and Protected stairs	30	E
9	Service shafts not fire stopped at every floor level	60 or 120	A or B
10	Openings in wall	30	F

3.8.4.4.34. Any fire door or fire shutter (excluding fire doors and fire shutters to service shaft and service rooms) shall be fitted with a self-closing or automatic closing device in accordance with the requirements ofISO 3008.

3.8.4.4.35. Any fire door which is required to have a specific fire resistance may be replaced by two separate fire doors which shall be positioned apart not less than one and half times the width of any leaf of such door, provided that the sum of the fire resistances of such separate doors shall not be less than the fire resistance required for the single door.

3.8.4.4.36. Any hinged fire doors installed shall be open in the direction of egress and be hinged on the same side.

3.8.4.5. PENETRATIONS

3.8.4.5.37. Penetrations for cables, cable trays, conduits, pipes, tubes, combustion vents and exhaust vents, wires, and similar items to accommodate electrical, mechanical, plumbing, and communications systems that pass through a wall, floor, or floor/ceiling assembly constructed as a fire barrier shall be protected by a fire stop system or device.

3.8.4.5.38. Any service that penetrates through any wall or floor where such wall or floor is required to have afire resistance shall be sealed in such a manner that the fire shall not penetrate such wall or floor.

3.8.4.6. DUCTS AND AIR TRANSFER OPENINGS

3.8.4.6.39. Fire dampers shall be installed to protect ducts and air-transfer openings that penetrate fire barriers and fire walls, their consideration will refer to ISO 10294-3. This shall also contain test procedures and requirements for windows, fire dampers, pipe and duct.

3.8.4.6.40. The materials and performance evaluation shall be based on requirements of ISO 3008 in conjunction with ISO 834-1, for specific method for determining the fire resistance of door and shutter assemblies designed primarily for installation within openings incorporated in vertical separating elements, such as hinged and pivoted doors, horizontally sliding and vertically sliding doors, including articulated sliding doors and sectional doors, steel single-skin folding shutters, other sliding, folding doors, tilting doors, rolling shutter doors and removable panels in walls.

3.8.4.7. SUSPENDED FLOORS AND LIFTED UP ACCESS OF COMBUSTIBLE MATERIAL

3.8.4.7.41. Apart from the case of any building classified R-4 or R-3 which does not exceed 2 storeys in height or in the case of any building classified R-5, no suspended floor, except a mezzanine floor, shall be permitted to be of combustible material except if such floor has ground directly below it or is not more than 50 mm above a non-combustible slab: Given that where the elements used for the construction of an access floor have been approved for such use by the approving Authority such access floor shall be permitted and:

(i) Any void below a lifted-up access floor shall be divided by fire stops into areas of not more than 300m^2 or shall be protected by a fixed automatic fire-fighting system; and

(ii) The void below an access floor shall not be connected to any space in another division unless such connecting opening is protected with a fire door, fire shutter or fire damper having the same fire resistance as the division separating element.

3.8.4.8. ROOF ASSEMBLIES AND COVERINGS

3.8.4.8.42. Where a roof of any part of a building meets any wall of a higher part of such building and such wall has any openings in any position within 10m above and 5m to either side of such roof and for a distance of not less than 5m from such wall shall have the fire resistance required for a division separating wall for the occupancy in question.

3.8.4.8.43. For any combustible roof covering material including thatch, shingles and bituminized felt on boarding that is used and planned area of such roof is more than 20m^2, the distance between the building so covered and any boundary of the site on which such building is situated shall be not less than 4.5m.

3.8.4.8.44. Where any roof covering includes individual small areas of combustible material, the total area of which is not more than 5% of the roof area, and where no such individual area is more than 20m^2 such roof covering shall not be considered a combustible roof covering provided that:

(i) Where the slope of the roof does not exceed 60 degrees there shall be a minimum distance of 1m between any two such areas; and

(ii) Where the slope of the roof is in excess of 60 degrees there shall be a minimum distance of 1m measured horizontally and 3.0m measured along the slope of such roof between any two such areas.

3.8.4.8.45. For roof space that is formed between any ceiling and any roof covering, such space shall be divided by means of non-combustible fire-stops into areas of not more than 300m^2 and the distance between such fire-stops shall be not more than 30m: Provided that this requirement shall not apply where such roof space and the room below are protected by a fixed automatic fire fighting system.

3.8.4.8.46. For any occupancy classified R-4 the walls separating dwelling units shall be extended and any such extension shall:

(i) Have the same fire resistance as the wall supporting it;

(ii) Be taken to the underside of any non-combustible roof or roof covering or any concrete slab below a combustible roof covering, as the case may be; and

(iii) Be taken to be not less than 0.3m above any combustible roof covering other than one laid on concrete.

3.8.4.9. CEILINGS

3.8.4.9.47. In any building not being a building classified R-5, combustible material shall not be used for any suspended ceiling except:

(i) Solid timber; and

(ii) Air supply or return air intake grilles of combustible material where the sum of the area of all such grilles forms not more than 5% of the total area of such ceiling.

(iii) Specific requirements for non-load-bearing ceiling elements shall comply with RS ISO 834-9

SECTION 5: SMOKE BARRIERS, PARTITIONS, PENETRATIONS & DUCTS

3.8.5.1. SMOKE BARRIERS

3.8.5.1.1. Smoke barriers shall be of materials permitted by the building type of construction.

3.8.5.1.2. One-hour fire-resistance rating is required for smoke barriers, except smoke barriers constructed of minimum of 2.5mm thick of steel in kiosks buildings.

3.8.5.1.3. Smoke barriers shall form an effective membrane continuous from outside wall to outside wall and from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, deck or slab above, including continuity through concealed spaces, such as those found above suspended ceilings, and interstitial structural and mechanicals paces.

Exception**:** Smoke-barrier walls are not required in interstitial spaces where such spaces are designed and constructed with ceilings that provide resistance to the passage of fire and smoke equivalent to that provided by the smoke barrier wall.

3.8.5.1.4. Openings in a smoke barrier shall be protected in accordance with opening protective.

3.8.5.1.5. Joints made in or between smoke barriers shall comply with fire resistant joint system.

3.8.5.1.6. Penetrations in a smoke barrier by ducts and air transfer openings shall comply with duct and air transfer opening.

3.8.5.1.7. Smoke barrier walls are not required in spaces designed with ceilings, walls, openings or roofs that resist to the passage of fire and smoke equivalent to that provided by smoke barrier walls.

3.8.5.1.8. Smoke barriers shall be available to every sub-divide of building used by patients for treatment or sleeping in order to avoid increase of sickness.

3.8.5.1.9. At least two smoke barriers should be in every building occupied by residents for sleeping or any other occupants of 50 people or more**.**

3.8.5.1.10. Buildings occupied by people that cannot protect themselves such prisons, jails, reformatories, detention centers, correctional centers and pre-release centers , shall have smoke barriers as follows:

(i) Divide every storey used by residents for sleeping or any other storey having 50 people or more into at least two compartments;

(ii) Limit the travelled distance to a door in smoke barrier:

a. From any room door to 30m;

b. From any point in a room to 45m; and

(iii) Limit the housing of maximum 200 residents into any smoke compartment.

3.8.5.1.11. Smoke barrier shall be constructed and scaled to limit leakage areas exclusive of protected openings. The maximum allowable leakage area has been calculated using leakage area ratios.

(i)	Walls	$A/A_W = 0.00100$
(ii)	Exit enclosures	$A/A_W = 0.00035$
(iii)	Other shafts	$A/A_W = 0.000150$
(iv)	Floors and roofs	$A/A_F = 0.00050$

Where: A: Total leakage area

A_F: Unit floor or roof area of the barrier

A_W: Unit wall area of barrier

3.8.5.2. SMOKE PARTITIONS

3.8.5.2.1. The walls shall be of materials permitted by the building type of construction.

3.8.5.2.2. Unless required elsewhere in the code, smoke partitions are not required to have a fire-resistance rating.

3.8.5.2.3. Smoke partitions shall extend from the top of the foundation or floor below to the underside of the floor or roof sheathing, deck or slab above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke.

3.8.5.2.4. Windows shall be sealed to resist the free passage of smoke or be automatic closing up on detection of smoke. Doors in smoke partitions shall comply with this section:

(i) Doors in smoke partitions shall not include louvers;

(ii) Where required elsewhere in the code, doors in smoke partitions shall meet the requirements for a smoke and draft control door assembly tested in accordance with ISO 5925-1; and

(iii) Where required elsewhere in the code, doors in smoke partitions shall be self-or automatic-closing by smoke detection in accordance with smoke activated doors.

3.8.5.2.5. The space around penetrating items and in joints shall be filled with an approved material to limit the free passage of smoke.

3.8.5.2.6. The space around a duct penetrating a smoke partition shall be filled with an approved material to limit the free passage of smoke. Air transfer openings in smoke partitions shall be provided with a smoke damper complying with damper rating. Exception: Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with smoke control systems, approved alternative protection shall be utilized.

3.8.5.2.7. Floor fire door assemblies used to protect openings in fire resistance rated floors shall be tested in accordance with standards methods of fire test of horizontal fire door assemblies installed in horizontal fire resistance rated assemblies.

3.8.5.3. SMOKE PENETRATIONS

3.8.5.3.1. Penetrations of fire-resistance-rated walls by ducts that are not protected with dampers shall comply with sub-regulation 3.8.5.3.2 through dissimilar materials. Penetrations of horizontal assemblies not protected with a shaft as permitted by a shaft enclosure and not required to be protected with fire dampers by other sections of this Code, shall comply with horizontal material through penetrating items. Ducts and air transfer openings that are protected with dampers shall comply with ducts and air transfer openings.

3.8.5.3.2. Where sleeves are used, they shall be securely fastened to the assembly penetrated. The space between the item contained in the sleeve and the sleeve itself and any space between the sleeve and the assembly penetrated shall be protected in accordance with this section. Insulation and coverings on or in the penetrating item shall not penetrate the assembly unless the specific material used has been tested as part of the assembly in accordance with this section.

3.8.5.3.3. Penetrations into or through fire walls, fire barriers, smoke barrier walls and fire partitions shall comply with 1 through dissimilar material. Penetration sin smoke barrier walls shall also comply with penetration in smoke barrier:

(i) Through penetrations of fire resistance rated walls shall comply with fire resistance rated assemblies or through penetration fire stop system. Except where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space between the penetrating item and the fire-resistance-rated wall is permitted to be protected;

(ii) Membrane penetrations shall comply with through penetrations. Where walls or partitions are required to have a fire-resistance rating, recessed fixtures shall be installed such that the required fire-resistance will not be reduced; and

(iii) Non-combustible penetrating items shall not connect to combustible items beyond the point of fire stopping unless it can be demonstrated that the fire resistance integrity of the wall is maintained.

3.8.5.3.4. Penetrations of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly not required to be enclosed in a shaft by Shaft enclosure required shall be protected in accordance with Fire-resistance-rated assemblies. Through non fire-resistance-rated assemblies:

(i) Penetrations of the fire-resistance-rated floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall comply with through penetrations through dissimilar materials; and

(ii) Through penetrations of fire-resistance-rated horizontal assemblies shall comply with Installation or Through-penetration fire stop system.

3.8.5.3.5. Penetrations in smoke barriers shall be tested in accordance with the requirements of air leakage. The air leakage rate of the penetration assemblies measured at 7.47Pa of water in both the ambient temperature and elevated temperature tests shall not exceed:

(i) $0.025 m^3/s.m^2$ of penetration opening for each through-penetration fire stop system; and

(ii) A total cumulative leakage $0.024 m^3/s$ for any 9.3 m^2 of wall area or floor area.

3.8.5.4. SMOKE DUCTS

3.8.5.4.1. Access doors in smoke ducts shall be tight fitting and meet the requirement for duct construction. Ducts are used as member of an approved smoke control system and the use of a fire damper shall interfere with the operation of smoke control systems.

3.8.5.4.2. Shaft enclosure allowed to be penetrated by ducts shall be protected by approved fire and smoke dampers installed according to their listing and usage:

(i) Ducts are used as a smoke control system where the fire damper will interfere with the smoke control system operation;
(ii) They shall not exceed $0.06m^2$;
(iii) They shall be of minimum thickness of 0.55mm;
(iv) Its openings shall not communicate with rooms and other adjacent spaces; and
(v) Installed above the ceiling.

3.8.5.4.3. Ducts that penetrate fire resistance rated assemblies and are not required by this section to have dampers shall comply with the requirements of Installation details through dissimilar materials. Ducts that penetrate horizontal assemblies not required to be contained within a shaft and not required by this section to have dampers shall comply with the requirements of horizontal assemblies through penetrating items.

SECTION 6: FIRE PROPERTIES FOR FINISHES

3.8.6.1. INTERIOR FINISHES

3.8.6.1.1. WALL AND CEILING FINISHES

3.8.6.1.1.1. Any combustible material shall be used as wall finish on any wall if the maximum area of the division in which such wall is located shall be not more than the relevant area illustrated in the Table 3.8.1-1. This shall not be applied to the buildings which are not more than 3 storeys and the ones provided with a fixed automatic fire-fighting system.

3.8.6.1.1.2. The required performance for interior wall and ceiling finishes materials shall be grouped in the following defined classes in accordance with their flame spread and smoke-developed indexes. A being the lowest flame spread and C being the highest:

(i) Class A: Flame spread index 0-25; smoke-developed index is 0-450;
(ii) Class B: Flame spread index 26-75; smoke-developed index is 0-450; and
(iii) Class C: Flame spread index 76-200; smoke-developed index is 0-450.

3.8.6.1.1.3. The wall and ceiling finish materials shall be permitted according to their fire resistance performance and smoke development index revealed in sub-regulation 3.8.6.1.1.2. Interior finishes for walls, ceilings and other interior surface of buildings shall be made of materials that shall not generate toxic smoke.

3.8.6.1.1.4. All materials that have a thickness less than 0.9mm applied directly to the surface of walls or ceilings shall not be subjected to pass through test standards.

3.8.6.1.1.5. Any combustible material used as a wall coating shall be of the type which has a classification superior to that specified in Table 3.8.6-1.

Table 3.8.6-1: Wall Finishes Classifications

S/N	Class of Occupancy	Classification						
		Basement of Building of any Height	**Building up to Three Storeys**		**Building Exceeding Three Storeys**		**Building of any Height**	
		Any Floor Area Except that Contained in Column 7 or Column 8					**Feeder Routes**	**Emergency Routes**
		USP or SP	USP	SP	USP	SP		
1	A-1	1	3	3	3	3	2	1
	A-2	1	3	3	3	3	2	1
	E-1&E-2	1	3	3	3	3	2	1
	A-4	1	4	4	3	4	2	1
2	F-1	NC	NC	NC	NC	NC	NC	NC
	F-2	2	3	4	3	4	3	1
	F-3	2	4	5	4	5	3	1
3	I-1	NC	2	2	2	2	2	1
	I-2	NC	2	2	2	2	2	1
4	M-1	3	2	3	2	3	2	1
	M-2	3	2	3	2	3	2	1
5	B-3	3	4	5	4	5	3	1
6	R-1	Not permitted	3	5	3	5	3	1
	R-3		3	4	2	4	3	1
	R4		4	5	3	4	3	1
	R2		4	5	3	4	3	1
7	S-1	NC	NC	NC	NC	NC	NC	NC
	S-2	NC	NC	NC	NC	NC	2	1
	S-3	2	3	4	2	3	2	1

NC – Non-combustible material only

SP – Protected by a sprinkler system

USP – Not protected by a sprinkler system

3.8.6.1.1.6. Interior finish materials which are required to be fire-resistance rated or to be constructed of non-combustible compartment materials shall be applied directly in opposition to the exposed surface of concealed spaces created thereby fire stopped where in excess of 3m when they are applied to walls, ceilings or structural elements of a building or structure.

3.8.6.1.2. INTERIOR FLOOR FINISHES

3.8.6.1.2.1. Any combustible material shall be used as floor covering if the maximum area of the division in which such floor is located, shall be not more than the relevant area illustrated in the Table 3.8.6-1.This regulation shall not be applied to the buildings which are not more than 3 storeys and the ones provided with a fixed automatic fire-fighting system.

3.8.6.1.2.2. The required performance for interior floor finishes and floor covering materials shall be considered and classified in accordance with ISO 9239-, ASTM D2646 - 18 and ASTM F1303 – 04 as follows for the most accurate measurement of critical radiant flux of floor covering systems:

(i) Class I, critical radiant flux $\geq$0.45 watts/cm^2; and

(ii) Class II, critical radiant flux> 0.22 watts/cm^2 $\leq$0.45 watts/cm^2

3.8.6.1.2.3. The performance evaluation test for interior floor finish and floor covering materials shall be tested in accordance with ISO 10295-2 or ASTM D2646 – 18 or ASTM F1303 – 04which ever is relevant, for fire tests on buildings materials and structures, methods for fire propagation.

3.8.6.1.2.4. In all occupancies, interior floor finish and floor covering materials in exit passageways, enclosures, corridors and rooms or spaces not divided from corridors by full height partitions extending from the floor to the underside of the ceiling shall resist a minimum critical radiant flux as specified in sub-regulation 3.8.6.2.2 of this Code.

3.8.6.1.3. INTERIOR DECORATIVE MATERIALS

3.8.6.1.3.1. All current draperies, hangings and other combustible decorative materials suspended from ceilings shall be tested to meet the requirements of flame propagation criteria of ISO 6940 and and ISO 6941.

3.8.6.1.3.2. Any material used as interior trim shall have a minimum class C flame spread and a smoke-developed index. Combustible trim, excluding handrails and guardrails, shall not exceed 10% of the specific wall or ceiling area in which it is attached.

3.8.6.2. PLASTER

3.8.6.2.1. The plaster shall be applied directly on concrete or masonry or on any approved non-combustible plastering base and furring.

3.8.6.2.2. The minimum thickness of plaster made either in gypsum or Portland cement in relation to the fire-resistant systems shall be established by the prescribed fire tests. For the fire-resistance purposes, the thickness of plaster shall be 25mm for Portland cement plaster or 19mm for gypsum sand plaster.

3.8.6.2.3. The plaster shall be protected with reinforcement with additional layer of approved lath embedded at least 19.1mm from the outer surface and fixed securely in place if the requirements of sub-regulation 3.8.6.2.2 are not fulfilled.

RWANDA BUILDING CODE

Chapter Three:
FIRE SAFETY

PART 9:

FIRE DETECTION & SUPPRESSION

SECTION 1: AUTOMATIC SPRINKLER SYSTEMS
SECTION 2: AUTOMATIC FIRE EXTINGUISHING SYSTEMS
SECTION 3: STANDPIPE SYSTEMS
SECTION 4: PORTABLE & MOBILE FIRE EXTINGUISHERS
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PART 9: FIRE DETECTION & SUPPRESSION

SECTION 1: AUTOMATIC SPRINKLER SYSTEMS

3.9.1.1. A fixed automatic sprinkler system that is designed, Installed and maintained by competent persons in accordance with relevant parts of ISO 6182 and in conjunction with RS 186, as appropriate shall be provided:

(i) In any building that exceeds 30m in height, except where such building is exclusively of an occupancy classified where the division size is not greater than 500m^2;

(ii) In any basement storey which exceeds 500m^2 in floor area; and

(iii) In any other storey which exceeds 500m^2 in total floor area and such storey is not provided with breakable or openable panels suitable for smoke-ventilation.

3.9.1.2. Any approved fixed means of automatic fire extinguishment shall be automatically connected independently to the backup system for emergency situations.

3.9.1.3. Any concealed space, not being a roof space, which has a clear height exceeding 800mm and a total area of compartment of more than 100m^2 above any ceiling or a total area of compartment of more than 300m^2 below any raised floor shall be equipped with a sprinkler system.

3.9.1.4. Any sprinkler system shall be fitted with twin coupling for the attachment of fire-pump and provided that:

(i) Such coupling shall be painted lime yellow;

(ii) The pressure exerted by such pump shall not be more than 1000Pa; and

(iii) Such pressure limitation shall be clearly marked on such coupling.

3.9.1.5. Each sprinkler system zone in buildings that are more than 128m in building height shall be supplied by a minimum of two risers. Each riser shall supply sprinklers on alternate floors. If more than two risers are provided for a zone, sprinklers on adjacent floors shall not be supplied from the same riser.

3.9.1.6. Smoke compartments containing patient sleeping units shall be equipped throughout with an automatic sprinkler system and shall be equipped with approved quick-response or residential sprinklers.

3.9.1.7. Stages shall be equipped with an automatic fire-extinguishing system. Sprinklers shall be installed under the roof and gridiron and under all catwalks and galleries over the stage. Sprinklers shall be installed in dressing rooms, performer lounges, shops and storerooms accessory to such stages.

3.9.1.8. Sprinklers are not required for stages $93m^2$ or less in area and 15.2m or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs and a single backdrop.

3.9.1.9. Actuation of the automatic sprinkler system shall immediately sound an alarm at the building at a constantly attended location from which emergency action.

3.9.1.10. Automatic sprinkler systems protecting commercial-type cooking equipment shall be supplied from a separate, readily accessible, indicating-type control valve that is identified.

3.9.1.11. In buildings where an automatic sprinkler system is required by this code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved.

3.9.1.12. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

3.9.1.13. An automatic sprinkler system shall be provided throughout assembly occupancy like night clubs, symphony and concert halls buildings in all its parts like floors, exit discharge comply with relevant parts of ISO 6182-10.

SECTION 2: AUTOMATIC FIRE EXTINGUISHING SYSTEMS

3.9.2.1. Automatic fire extinguishing systems shall be installed on each floor at a distance of 15m apart.

3.9.2.1.1. Where storage of goods is to a height of more than 3m in any occupancy classified S-1 or S-2, an approved fixed installation of automatic fire extinguisher shall be provided at the maximum division area Table 3.8.1-1 in accordance with part8, Section 1 of this Code.

3.9.2.1.2. Each required commercial kitchen exhaust hood and duct system shall be protected with an approved automatic fire-extinguishing system installed in accordance with ISO 6183. Inspection and maintenance of fire extinguishers shall be done in accordance with ISO/TS 11602-2.

3.9.2.1.3. Electrical wiring for Automatic fire-extinguishing systems shall be installed and governed in accordance with RS EAS 811 and conductors and insulated cables shall comply with RS IEC 60228 and in case of power cut, shall automatically use standby power or emergency power.

3.9.2.1.3.1. Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance Manual system operation:

(i) A manual actuation device shall be located at or near a means of egress from the cooking area a minimum of 3.0m and a maximum of 6.1m from the kitchen exhaust system. The manual actuation device shall be installed at 1.2m above the floor and shall clearly identify the hazard protected; and

(ii) The manual actuation shall require a maximum force of 178N and a maximum movement of 356mm to actuate the fire suppression system.

3.9.2.1.3.2. The actuation of the fire suppression system shall automatically shut down the fuel or electrical power supply to the cooking system.

3.9.2.1.3.3. Automatic equipment interlocks with fuel shutoffs, ventilation controls, door closers, window shutters, conveyor openings, smoke and heat vents and other features necessary for proper operation of the fire extinguishing system shall be provided as required by the design and installation standard utilized for the hazard refer to RS ISO 14520-1.

3.9.2.1.3.4. Where alarms are required to indicate the operation of automatic fire-extinguishing systems, distinctive audible and visible alarms and warning signs shall be provided to warn of pending agent discharge and where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Audible signals shall be in accordance with RS 186-4.

3.9.2.1.3.5. Monitoring of fire extinguishing systems; Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with ISO 7240.

3.9.2.2. Fire extinguishing systems shall be inspected and tested in accordance with the provisions of RS ISO 116024.

3.9.2.2.1. Prior to conducting final acceptance tests, the inspection of automatic fire extinguishing systems should refer to ISO 11602.

(i) Hazard specification for consistency with design hazard;
(ii) Type, location and spacing of automatic- and manual-initiating devices;
(iii) Size, placement, hose reel and position of nozzles or discharge orifices;
(iv) Location and identification of audible and visible alarm devices;
(v) Identification of devices with proper designations; and
(vi) Operating instructions.

3.9.2.3. Monitoring and testing of fire alarm connected to automatic fire-extinguishing systems**.** Connections to protected premises and supervising station fire alarm systems shall be tested to verify proper identification and retransmission of alarm from automatic fire-extinguishing systems.

3.9.2.4. Dry and wet chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with ISO 6182-1 and RS186-4 and ISO 7202 respectively and their listing.

3.9.2.5. Foam-extinguishing systems shall be installed, maintained, inspected and tested periodically.

3.9.2.6. Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with ISO 6183, ISO/TS 11602-2 and ISO 6182 respectively.

3.9.2.6.1. Dampers shall be installed at either the top or the bottom of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. Where the damper is installed at the top of the duct, the top nozzle shall be immediately below the damper.

3.9.2.6.2. Automatic carbon dioxide fire-extinguishing systems shall be sufficiently sized to protect against all hazards venting through a common duct simultaneously.

3.9.2.7. Clean-agent and Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with ISO/TS 11602-2 and ISO 7201-1 respectively and their listing.

3.9.2.7.1. The automatic fire-extinguishing system for commercial cooking systems shall be of a type recognized for protection of commercial cooking equipment and exhaust systems of the type and arrangement protected as referred to IEC 309.

3.9.2.7.2. Commercial-type cooking equipment protected by an automatic carbon dioxide-extinguishing system shall be arranged to shut off the ventilation system upon activation refer to IEC 68-2-1 and ISO 21927-10.

SECTION 3: STANDPIPE SYSTEMS

3.9.3.1. CLASSES OF STANDPIPE SYSTEM

The standpipe system shall be in accordance with the following three classes:

(i) A system providing 64mm hose connections to supply water for use by fire departments and those trained in handling heavy fire streams;

(ii) A system providing 38mm hose stations to supply water for use primarily by the building occupants or by the fire department during initial response; and

(iii) A system providing 38mm hose stations to supply water for use by building occupants and 64mm hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

3.9.3.2. The stand pipe system that are used in construction shall be matched with the following types:

(i) Standpipe system filled with pressurized air that is arranged through the use of a device, such as dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand;

(ii) A wet standpipe system that has a water supply that is capable of supplying the system demand automatically;

(iii) A dry standpipe system that does not have a permanent water supply attached to the system; in order to meet the system demand, manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection;

(iv) A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but does not have a water supply capable of delivering the system demand attached to the system. In order to meet the system demand, manual-wet standpipe systems require water from a fire department pumper to be pumped into the system; and

(v) A dry standpipe system that is arranged using a device, such as a deluge valve, to admit water into the system piping upon activation of a remote-control device located at a hose connection. A remote-control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

3.9.3.4. INSTALLATION OF STANDPIPE

3.9.3.4.1. The cover shall be of steel or other hard metal not readily attacked by cement paste, shall have corrosion resistance and shall have interior surfaces inclined at not less than 10° from the surface of the flange.

3.9.3.4.2. The outer rim and lower surface of the flange and the sloping interior face shall be machined to a smooth finish. The cover shall have provision for being clamped to the container to make a pressure seal without entrapping air at the joint between the flanges of the cover and the container.

3.9.3.4.3. Class 3 standpipe systems shall be installed throughout buildings where the floor level of the highest story is located more than 9.1m above the lowest level of fire department vehicle access, or where the floor level of the lowest story is located more than 9.1m below the highest level of fire department vehicle access. Exceptions:

(i) Class 1 standpipes are allowed in buildings equipped throughout with an automatic sprinkler system;

(ii) Class 1 manual standpipes are allowed in open parking garages where the highest floor is located not more than 45.7m above the lowest level of fire department vehicle access;

(iii) Class 1 manual dry standpipes are allowed in open parking garages that are subject to freezing temperatures, provided that the hose connections are located as required for Class 2 standpipes; and

(iv) Class 1 standpipes are allowed in basements equipped throughout with an automatic sprinkler system.

3.9.3.4.4. Class 1 automatic wet standpipes shall be provided in non-sprinkled buildings having an occupant load exceeding 1000 persons. Exceptions:

(i) Open-air-seating spaces without enclosed spaces; and

(ii) Class 1 automatic dry and semiautomatic dry standpipe or manual wet standpipes are allowed in buildings where the highest floor surface used for human occupancy is 22.9m or less above the lowest level of fire department vehicle access.

3.9.3.4.5. A covered mall building shall be equipped throughout with a standpipe system where required. Covered mall building not required to be equipped with a standpipe system by sub-regulation 3.9.3.5.1 shall be equipped with Class 1 hose connections connected to the automatic sprinkler system sized to deliver water at 1000 L/M at the most hydraulically remote hose connection while concurrently supplying the automatic sprinkler system demand. The standpipe system shall be designed not to exceed 345kPa residual pressure losses with a flow of 1000 L/M from the fire department connection to the hydraulically most remote hose connection. Hose connections shall be provided at each of the following locations:

(i) Within the mall at the entrance to each exit passageway or corridor;

(ii) At each floor-level landing within enclosed stairways opening directly on the mall;

(iii) At exterior public entrances to the mall; and

(iv) At other locations as necessary so that the distance to reach all portions of tenant space does not exceed 60m from a hose connection;

3.9.3.5. MATERIALS

All standpipes shall be constructed of approved materials by Rwanda standard board. All pipes, fittings and valves shall be of extra heavy pattern when the normal working pressure shall be specified.

3.9.3.6. CONSTRUCTION AND TESTS

3.9.3.6.1. All standpipe systems shall be flow tested and hydrostatical tested in accordance with the standards for fire protections.

3.9.3.6.2. Dry and wet standpipes shall be of wrought iron or galvanized steel and together with fittings and connections shall be of enough strength to withstand enough water pressure when ready for service, without leaking at the joints, valves, or fittings.

3.9.3.6.3. Tests shall be conducted by the owner or the building contractor in the presence of a representative of the Authority whenever deemed necessary for the purpose of certification of its proper function and that shall be approved by national institution in charge of standards after checking all requirements.

3.9.3.7. SIGNS

An iron or bronze sign with raised letters at least 25mm high shall be rigidly attached to the building adjacent to all Siamese connections and such signs shall read: “CONNECTION TO THE STANDPIPE”

3.9.3.8. COMBINATION OF STANDPIPE AND SPRINKLER SYSTEM

3.9.3.8.1. Where a standpipe system riser also serves as the water sprinkler system riser in buildings required to have both systems or in buildings having both systems, control valves shall be installed where sprinklers are connected to the riser so that sprinklers are under the control of a separate floor control valve(s) to allow standpipes to remain operational while the sprinkler system is in a closed position.

3.9.3.8.2. If control valves are located in a separate room or building, a sign shall be provided on the entrance door. The lettering of such sign shall be of a clear color and shall be at least 100mm in height and shall read “Standpipe Control Valve” or indicate other types of systems.

3.9.3.9. INSTALLATION REQUIREMENT

Standpipe systems shall be installed where required by building height through Marinas and boatyards, and in the locations indicated in each standpipe classes. Standpipe systems can be combined with automatic sprinkler systems.

Generally, standpipe systems are not required in one and two-family dwellings or in underground houses.

3.9.3.9.1. STANDPIPE SYSTEMS IN BUILDING HEIGHT

3.9.3.9.1.1. Class 3 standpipe systems shall be installed throughout buildings where the floor level of the highest story is located above the lowest level of fire department vehicle access.

Exceptions:

(i) Class 1 standpipe systems are allowed in buildings equipped throughout with an automatic sprinkler system;

(ii) Class 1 manual standpipe systems are allowed in open parking garages where the highest floor is located not more than 45.7m above the lowest level of fire department vehicle access;

(iii) Class 1 manual dry standpipe systems are allowed in open parking garages that are subject to freezing temperatures, provided that the hose connections are located as required for Class 2 standpipes in accordance with standpipe connections; and

(iv) Class 1 standpipe systems are allowed in basements equipped throughout with an automatic sprinkler system.

3.9.3.9.1.2. Wherever required in all buildings, standpipes are used depending to its storeys or height.

Table 3.9.3-1: Supply Pipe Sizing

S/N	Maximum Building Height (m)	Minimum Riser Size (mm)
1	4 storeys or 15.24	62
2	6 storeys or 22.86	100
3	23.16m to 76.20	150
4	Over 76.20	200

3.9.3.10. STANDPIPE IN MALL BUILDINGS

3.9.3.10.1. A covered mall building shall be equipped throughout with a standpipe system where required by building height. Covered mall buildings not required to be equipped with a standpipe system by building height shall be equipped with class 1 hose connections connected to a system sized to deliver water at specified discharge.

3.9.3.10.2. Hose connections shall be provided at each of the following locations:

(i) Within the mall at the entrance to each exit passageway or corridor;

(ii) At each floor-level landing within enclosed stairways opening directly on the mall; and

(iii) At exterior public entrances to the mall.

3.9.3.10.3. UNDERGROUND BUILDINGS

Underground buildings shall be equipped throughout with a Class 1 automatic wet or manual wet standpipe system.

3.9.3.10.4. HELISTOPS AND HELIPORTS

Buildings with a helistop or heliport that are equipped with a standpipe shall extend the standpipe to the roof level on which the helistop or heliport is located in accordance with Rwanda Standard for fire protections.

3.9.3.11. LOCATION OF CLASS 1 STANDPIPE HOSE CONNECTIONS

3.9.3.11.1. Class 1 standpipe hose connections shall be provided in all the following locations:

(i) In every required stairway, a hose connection shall be provided for each floor level above or below grade;

(ii) Hose connections shall be located at an intermediate floor level landing between floors, unless otherwise approved by the fire code official;

(iii) On each side of the wall adjacent to the exit opening of a horizontal exit; and

(iv) In every exit passageway at the entrance from the exit passageway to other areas of a building.

3.9.3.11.2. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall.

3.9.3.12. PROTECTION

3.9.3.12.1. Risers and laterals of class 1 standpipe systems not located within an enclosed stairway or pressurized enclosure shall be protected by a degree of fire resistance equal to that required for vertical enclosures in the building in which they are located.

3.9.3.12.2. Except in buildings equipped throughout with an approved automatic sprinkler system, laterals that are not located within an enclosed stairway or pressurized enclosure are not required to be enclosed within fire-resistance-rated construction.

3.9.3.12.3. In buildings where more than one standpipe is provided, the standpipes shall be interconnected.

3.9.3.13. LOCATION OF CLASS 2 STANDPIPE HOSE CONNECTIONS

3.9.3.13.1. Class 2 standpipe hose connections shall be accessible and located so that all portions of the building are within 0.9m of a nozzle attached to 30.5m of hose.

3.9.3.13.2. Fire-resistance-rated protection of risers and laterals of Class II standpipe systems is not required.

3.9.3.13.3. In buildings where more than one class 2 standpipes required, the standpipe system shall provide 38.1mm hose stations to supply water for use primarily by trained personnel or by the fire department during initial response.

3.9.3.14. LOCATION OF CLASS 3 STANDPIPE HOSE CONNECTIONS

3.9.3.14.1. Class 3 standpipe systems shall have hose connections located as required for class 1 standpipe and shall have class 2 hose connections as required.

3.9.3.14.2. Risers and laterals of class 3 standpipe systems shall be protected as required for class 1 systems.

3.9.3.14.3. In buildings where more than one class 3 standpipes is provided, the standpipes shall be interconnected at the bottom.

3.9.3.15. VALVE SUPERVISION

3.9.3.15.1. Valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by sprinkler system monitoring and alarms where a fire alarm system is provided, a signal shall also be transmitted to the control unit. Exceptions:

(i) Valves to underground key or hub valves in roadway boxes provided by the town or public utility do not require supervision; and

(ii) Valves locked in the normal position and inspected as provided in this code in buildings not equipped with a fire alarm system.

3.9.3.16. STANDPIPES FOR BUILDINGS UNDER CONSTRUCTION OR DEMOLITION

3.9.3.16.1. Standpipes required by this section are to be either temporary or permanent in nature, with or without a water supply, provided, however, that such standpipes conform to the requirements of health hazards as to number of risers, capacity, outlets and materials.

3.9.3.16.2. Provisional or permanent standpipes shall be installed, as the work of the building progresses, beginning at the fifth storey.

3.9.3.16.3. In construction progresses the standpipe shall be carried up with each floor and shall be installed and ready for use. Standpipes shall be extended as construction progresses to within one floor of the highest point of construction having secured decking.

3.9.3.16.4. Hose outlets shall be provided with caps and attachment chains and all outlets of standpipe shall be equipped with gate valves.

3.9.3.16.5. Temporary or permanent standpipe installation shall be provided at the street level connected to one or more two-way fire department inlet connections. Fire department inlet connections shall always be prominently marked and readily and easily accessible .

3.9.3.16.6. Where a building is being demolished and a standpipe is existing within such a building. Such standpipe shall be maintained in an operable condition in order to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be more than one floor below the floor above being demolished.

SECTION 4: PORTABLE & MOBILE FIRE EXTINGUISHERS

3.9.4.1. For the relevant occupancy and floor area, any building containing an occupancy given in Table 3.9.4-1 shall be provided with portable fire extinguishers, as prescribed table, in approved positions.

3.9.4.2. Approved of portable fire extinguisher installed in a building shall comply with the requirements contained in RS ISO 7165, and relevant parts of RS ISO 11602-1 and RS ISO 11602-2, shall be installed, maintained and serviced in accordance with institution in charge of standards.

3.9.4.3. Authority may specify the type of portable fire extinguisher to be provided and may require that the number of fire extinguishers shall be installed in excess of the number indicated in Table 3.9.4-1 if in its opinion any particular hazards risks warrant such increase.

3.9.4.4. Such portable fire extinguishers shall bear a certification mark from an accredited certificate on body in this Code or where it cannot so bear such mark shall be clearly marked by the institution in charge of standards to indicate that it has been evaluated and is acceptable by the institution in charge of standards.

3.9.4.5. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

3.9.4.6. For the occupancy in which it is installed, the type of portable fire extinguisher shall have a capacity or mass rating as follows:

(i) for an occupancy classified A-1, A-2, A-3, A-4, A-5, I-1, I-2, I-3, M-1, M-2, M-3, B-3, R-1, R-3 or R-4.

a. water type of 9 litres
b. Foam type of 9 litres
c. Carbon dioxide type of 4.5kg
d. Dry chemical type of 9kg

(ii) For an occupancy classified A-1, A-2, B-1, B-2, B-3, F-1, F-2, F-3, F-4, S-1, S-2 or S-3.

a. water type of 9 litres
b. Foam type of 9 litres
c. Carbon dioxide type of 5kg
d. Dry chemical type of 9kg

Table3.9.4-1: Provision of Portable Extinguishers

S/N	Classification of Occupancies	Number of Portable Fire Extinguishers Relative to Floor Area (m^2)
1	B-1, F-1, F-2, S-1, S-2, S-3	1 per 100
2	A-1, A-2, A-3, B-2, F-3, I-1, I-2, I-3, M-1, M-2, M-3, B-3, R-1, R-3	1 per 200
3	A-4, A-5, B3, F-4, R-4, S-4	1 per 400

3.9.4.7. MOBILE FIRE EXTINGUISHERS

3.9.4.7.1. Any fire extinguisher exceeding the capacities prescribed in the relevant institution in charge of standards specification and fitted with suitable wheels for transportation shall be deemed to be a mobile fire extinguisher.

3.9.4.7.2. An approved mobile fire extinguisher may replace half the portable fire extinguisher as given in Table3.9.4-1, provided that:

(i) The capacity of any such mobile fire extinguisher shall be at least equal to the combined capacity of the number of portable fire extinguisher it replaces;
(ii) It contains the same extinguishing medium as required for such portable extinguisher;
(iii) It replaces such portable extinguisher only on the floor and with the division concerned;

(iv) The floor area to be served by it does not exceed 500% of that given in Table 3.9.4-1 or 100% on single level, whichever is the lesser;

(v) Such mobile fire extinguisher is kept in readily accessible position; and

(vi) The extinguishing medium complies with the appropriate requirements of institution in charge of standards.

3.9.4.8. PROVISION

3.9.4.8.1. Such portable fire extinguisher shall bear the mark of standardization as contemplated in these regulations or where it cannot so bear such mark be clearly marked by the institution in charge of standards to indicate that it has been evaluated by and is acceptable to institution in charge of standards.

3.9.4.8.2. Employee's assigned fire-fighting duties shall be trained to know the locations and proper use of portable fire extinguishers.

3.9.4.8.3. Every building must have portable fire extinguisher for fire protection purpose. For buildings which have no portable fire extinguisher before, should be installed for fire fighting.

SECTION 5: FIRE ALARMS & DETECTION SYSTEMS

3.9.5.1. GENERAL REQUIREMENTS

3.9.5.1.1. Any building with following occupancy shall have a fire detection system:

(i) I-2, irrespective of height or floor area;
(ii) B-3, with a floor area of more than 500 m^2; and
(iii) R-1 or R-3, with a height of more than 8m.

3.9.5.1.2. Any occupied building exceeding 30m in height or containing any storey exceeding 5000m^2 in floor area, other than a building mentioned in sub-regulation 3.9.5.1.1 shall be equipped with fire detection and manually activated fire alarm system and an emergency evacuation communication system.

3.9.5.1.3. The drawings for fire alarm systems shall be submitted to the Authority for review and approval prior to system installation.

3.9.5.1.4. Fire alarm systems shall be installed on each section.

3.9.5.2. FIRE SAFETY FUNCTIONS

3.9.5.2.1. Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building's fire alarm control unit where a fire alarm system is required.

3.9.5.2.2. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or activate a visible and audible supervisory signal at a constantly attended location.

3.9.5.2.3. In buildings which are not equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function.

3.9.5.3. INITIATING DEVICES

3.9.5.3.1 In areas that are not continuously occupied, single smoke detector shall be provided at the location of each fire alarm control unit, notification appliance circuit power extenders, and supervising station transmitting equipment.

3.9.5.3.2 Where a manual fire alarm system is required, it shall be activated by fire alarm boxes installed in accordance of this Code.

3.9.5.3.3 Where an automatic smoke detection system is required it shall utilize smoke detectors unless ambient conditions prohibit such an installation. In spaces where smoke detectors cannot be utilized due to ambient conditions, approved automatic heat detectors shall be permitted.

3.9.5.3.3.1 For conditions other than specific fire safety functions noted in sub-regulation 3.9.5.2; in areas where ambient conditions prohibit the installation of smoke detectors, an automatic sprinkler system installed in such areas in accordance with Part 9, Section 1 of this Code and that is connected to the fire alarm system shall be approved as automatic heat detection.

3.9.5.4. OCCUPANT NOTIFICATION SYSTEMS

3.9.5.3.4 A presignal feature shall not be installed unless approved by the Authority and the fire department. Where a presignal feature is provided, a signal shall be annunciated at a constantly attended location approved by the fire department, in order that occupant notification can be activated in the event of fire or other emergency.

3.9.5.3.5 ALARM NOTIFICATION APPLIANCES

3.9.5.3.5.1 Any building classified in these occupancies A-1, A-5, A-3, or B-3 shall equipped with manually activated audible alarm system emitting a distinctive sound that is not to be used for any purpose other than that of a fire alarm.

3.9.5.5.2.1.1. The audible alarm notification appliances shall provide a sound pressure level of 15 decibels above the average ambient sound level or 5 decibels above the maximum sound level having duration of at least 60 seconds, whichever is greater, in every occupiable space within the building.

3.9.5.5.2.1.2. The maximum sound pressure level for audible alarm notification appliances shall be 110 decibels at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than 95 decibels, visible alarm notification appliances shall be provided**.**

3.9.5.4.2.2. VISUAL NOTIFICATION APPLIANCES FOR FIRE ALARM SYSTEMS

3.9.5.4.2.2.1. Visual notification appliances shall only be required to be installed in public and common areas.

3.9.5.4.2.2.2. Visual notification appliance circuits shall have a minimum of 25% spare capacity to accommodate additional visual notification appliances being added to accommodate employees who are deaf or have hearing impairments.

3.9.5.4.2.2.3. Visual notification appliances shall not be installed in exit enclosures i.e., exit stairs.

3.9.5.4.2.2.4. Visible appliances shall include on their nameplates reference to their parameters or reference to installation documents.

3.9.5.5. INSTALLATION OF FIRE ALARM SYSTEMS

3.9.5.3.6 A fire alarm and detection systems shall be installed in accordance with RS 186-4.

3.9.5.3.7 Each floor shall be zoned separately, and a zone shall not exceed 2090m^2 and the length of any zone shall not exceed 92m. In high-rise buildings, a separate zone by floor shall be provided for each of the following types of alarm-initiating devices where provided:

(i) Smoke detectors;

(ii) Sprinkler water flow devices;

(iii) Manual fire alarm boxes; and

(iv) Other approved types of automatic fire detection devices or suppression systems.

3.9.5.3.7.1 A zoning indicator panel and the associated controls shall be provided in an approved location.

3.9.5.3.8 For the purpose of emergency, the fire alarm and detection systems shall be connected to the backup power which will help those systems to work properly in case of fire outbreak.

3.9.5.3.9 Access shall be provided to each fire alarm device and notification appliance for periodic inspection, maintenance and testing.

3.9.5.6. COMPLETION AND TESTS OF ACCEPTANCE

3.9.5.3.10 Upon completion of the installation, the fire alarm system and all fire alarm components shall be tested in accordance with this Code.

3.9.5.3.11 When the installation of the alarm devices is complete, each device and interconnecting wiring for multiple-station alarm devices shall be tested the fire brigade in accordance with this Code.

3.9.5.3.12 A record of completion in accordance with this Code verifying that the system has been installed and tested in accordance with the approved plans and specifications shall be provided.

3.9.5.7. INSPECTION AND MAINTENANCE

3.9.5.3.13 The maintenance for fire alarm and fire detection systems shall be done in accordance with RS 186-4.

3.9.5.3.14 The fire alarm and detection systems shall be inspected for every 3months.

SECTION 6: SMOKE CONTROL

3.9.6.1. Apart from the requirements for the total area of any opening and door or openable glazed window given in the Section about Natural ventilation; any room of which the floor area is more than 500m^2 shall be provided with:

(i) A system of mechanical smoke ventilation; and

(ii) Any single storey building or room that has a floor area up to 2500m^2 and that is not fitted with a sprinkler protection system, roof ventilators or openable windows or panels to permit smoke ventilation and such roof ventilators or openable windows or panels shall:

a. Have an aggregate area of not less than 3% of the floor area of such room or, in the case of any single storey building where such room has an occupancy classified F-2 or F-3, not less than 1.5% of the floor area of such room;
b. Be designed to open automatically when activated by heat or smoke detectors or, where not so designed, shall be capable of being manually operated, without the use of special tools, from the floor of such room: Provided that where such room is so situated that neither a roof space nor an external wall of the building form part of such room, such room shall be equipped with a system of mechanical smoke ventilation;
c. Be in the roof or in the upper third of the walls, as the case may be, and be distributed in such a way that smoke will be evenly extracted from all parts of the room; and
d. Be designed to maintain a clear layer of 2.5m above the floor of the highest occupied level.

3.9.6.2. SMOKE CONTROL SYSTEMS

3.9.6.2.1. A combination of fans, dampers, warning devices, within the building shall be shown on the fire-fighter's control panel with a clear indication of the direction of airflow and the relationship of components shall be displayed.

3.9.6.2.2. Smoke detectors shall be installed on each floor.

3.9.6.2.3. Status indicators shall be provided for all smoke control equipment, enunciated by fan and zone, and by pilot-lamp-type indicators as follows:

(i) Fans, dampers and other operating equipment in their normal status-white;
(ii) Fans, dampers and other operating equipment in their off or closed status-red;
(iii) Fans, dampers and other operating equipment in their own or open status-green; and
(iv) Fans, dampers and other operating equipment in a fault status-yellow/amber.

3.9.6.2.4. In the building the fire-fighters' control panel shall provide control capability over the complete smoke-control system equipment as follows:

(i) On-auto-off control over each individual piece of operating smoke control equipment that can also be controlled from other sources within the building. This includes stairway pressurization fans; smoke exhaust fans; supply, return and exhaust fans; elevator shaft fans and other operating equipment used or intended for smoke control purposes;
(ii) Open-auto-close control over individual dampers relating to smoke control and that are also controlled from other sources within the building; and
(iii) On-off or open-close control over smoke control and other critical equipment associated with a fire or smoke emergency and that can only be controlled from the fire-fighter's control panel.

3.9.6.2.5. Smoke control system shall activate dampers and fans to be initiated immediately after receiving of an appropriate automatic or manual activation command.

SECTION 7: FIRE PUMPS

3.9.7.1. The fire pump, driver and controller shall be protected against possible interruption of service through damage caused by explosion, fire, flood, earthquake, rodents, insects, windstorm, freezing, vandalism and other adverse condition.

3.9.7.2. Fire pumps shall be located in rooms that are separated from all other areas of the building by 2-hour fire barrier constructed in accordance with fire barriers or 2 hours horizontal assemblies constructed in accordance with horizontal assemblies or both.

3.9.7.3. Suitable means shall be provided for maintaining the temperature of a pump room or pump house, where required, above 40°F.

3.9.7.4. Temperature of the pump room, pump house or area where Engines are installed shall never be less than the minimum recommended by the engine manufacturer. The engine manufacturer's recommendations for oil heaters shall be followed.

3.9.7.5. Fire pump test outlet valves shall be supervised in the closed position.

3.9.7.6. REQUIREMENTS

3.9.7.6.1. The pump intake shall be either connected to the public underground water supply piping or a static water source (tank, reservoir).

3.9.7.6.2. Fire pump for protection purposes shall be usually driven by an independent reliable prime mover.

3.9.7.6.3. The fire pumps shall be installed on the building for fire protection in the fire pumps rooms.

3.9.7.6.4. Fire pumps shall be supplied with an adequate source of power and shall be automatic in operation.

3.9.7.6.5. Fire pumps shall have a capacity required with a pressure at the topmost hose outlet.

3.9.7.6.6. The source of supply for such pump shall be a street water main of not less than 100mm diameter or a well or cistern containing a one-hour supply.

3.9.7.6.7. If the building does not have enough municipal water supply for design of a fire sprinkler system available to the floor without installation of a new fire pump, work areas shall be protected by an automatic smoke detection system throughout all occupied spaces other than sleeping units or individual dwelling units that activates the occupant notification system.

3.9.7.6.8. Fire pumps shall be needed when the local municipal water system cannot provide sufficient pressure to meet the hydraulic design requirements of the fire sprinkler system. This usually occurs if the building is very tall, or in systems that require a relatively high terminal pressure at the fire sprinkler in order to provide a large volume of water.

3.9.7.7. LOCATION OF FIRE PUMPS

3.9.7.7.1. Fire pumps shall be located in rooms that are separated from all other areas of the building by 2 hours fire barriers or 2 hours horizontal assemblies, or both.

Exceptions: In other than high-rise buildings, separation by 1hour fire barriers constructed or 1hour horizontal assemblies, or both, shall be permitted in buildings equipped throughout with an automatic sprinkler system.

3.9.7.7.2. Suitable means shall be provided for maintaining the temperature of a pump room or pump house, where required, above 11°c.Temperature of the pump room, pump house or area where engines are installed shall never be less than the minimum recommended by the engine manufacturer.

3.9.7.7.3. Do not place or store hazardous refrigerants, gas pipes, gas meters or gas-consuming devices in a fire pump room.

3.9.7.8. OPERATION

3.9.7.8.1. Water supply to required fire pumps shall be supplied by connections to a minimum of water main located in different streets or storage tank.

3.9.7.8.2. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

3.9.7.8.3. The fire extinguishing system in any building shall be equipped with automatic pump starting mechanisms and shall be fitted with an alarm system designed to emit a continuous audible warning whenever any pump installed in the system is activated.

3.9.7.8.4. The reflux valve in a fire extinguishing system in any building shall not be positioned to prevent the flow of water from a fire-pump connection to a hydrant valve or fitted hose reel that is connected to the system.

3.9.7.9. PROVISION

3.9.7.9.1. Every high-rise building must have fire pumps for protection purpose. For buildings which did not have fire pumps before, they should be installed for firefighting.

3.9.7.9.2. Hose reels shall be installed on each floor.

3.9.7.10. SUPERVISION

3.9.7.10.1. Where provided, the fire pump suction, discharge and bypass valves, and isolation valves on the backflow prevention device or assembly shall be supervised open by one of the following methods:

(i) Central-station, proprietary or remote-station signalling service;

(ii) Local signalling service that will cause the sounding of an audible signal at a constantly attended location;

(iii) Locking valves open; and

(iv) Sealing of valves and approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

3.9.7.10.2. There should be supervision periodically to check whether fire pump connections are well connected or there is no leakage.

3.9.7.10.3. Fire pump test outlet valves shall be supervised in the closed position.

SECTION 8: FIRE HYDRANTS

3.9.8.1. Hydrants in positions subject to direction by the local authority shall be provided in:

(i) Any building that exceeds 12m in height; and

(ii) Any building of any height with a total floor area that exceeds 1000m^2

3.9.8.2. Any hydrant required in terms of sub-regulation 3.9.9.3 shall be provided at a rate of not fewer than one per 1000m^2 or part thereof of total floor area and not fewer than one per storey located in the firemen's lift lobby in such building or occupancy, or emergency stairway where no firemen's lift is provided, as the case might be, and shall be distributed in such a manner that the fire hose referred to in sub-regulation 3.9.9.5 can reach to every part of the relevant area.

3.9.8.3. Any hydrant shall be provided with an appropriate fire hose of 24m or 30m in length, together with couplings and a 45 and /or 75mm internal diameter nozzle, such hose and nozzle shall, when positioned in the open air or in any factory building, be suitably housed in a cupboard.

3.9.8.4. In any industrial park, permanent amusement park or exhibition ground, shopping center or group housing, cluster housing, or townhouse complex there shall be installed ground or raised hydrants so placed that no point in such amusement park or exhibition ground or shopping center or in any building in such housing complex shall be at a distance greater than 90m from any hydrant.

3.9.8.5. A hydrant shall comply with the requirements of relevant part of ISO 6182-16.

3.9.8.6. Hydrants shall not be used for any other purpose other than fire protection without express permission of the local Water Authority.

3.9.8.6.1. Public fire hydrants shall be installed and maintained by the Authority. These shall be installed in public rights-of-way, City-owned property, or City-approved easement and connected to local Authority water mains.

3.9.8.6.2. Public fire hydrants shall be located in streets or roads dedicated to public use. Locations of public fire hydrants shall be approved by the local Water Authority prior to installation. Any applicant wishing to use those public fire hydrants shall pay the appropriate charge.

3.9.8.7. Anyone who operates or attempts to operate a fire hydrant without permission of the local Water Authority shall be guilty of an offence, except in the event of an emergency.

3.9.8.8. Where the gradient of an existing street or property is changed at the request of the property owner, such that an existing public fire hydrant will not be at the proper elevation with respect to the ground, the hydrant will be raised or lowered at the expense of the property owner.

3.9.8.9. Shrubs, trees, flowers or weeds shall not be planted nor permitted to grow so as to prevent full view of a fire hydrant from the street.

3.9.8.10. Painting of fire hydrants shall be done by the local authority only. The hydrant bonnets are color coded to show the amount of water that can be discharged out of them as specified in Table 3.9.8-1 below.

Table 3.9.8-1: Colours showing the amount of water that can be discharged out

S/N	Bonnet Colour	Litters per Minute
1	Green	4,000 or greater
2	Orange	2,000 - 4,000
3	Red	Less than 2,000

3.9.8.11. Hose reels for the purposes of fire-fighting shall be installed in any building of two or more storeys in height or in any single-storey building of more than 250m^2 in floor area at a rate of 1 hose reel for every 500m^2 or part thereof of floor area of any storey; provided that such hose reels shall not be required in any building in any dwelling unit provided with independent access to ground level.

3.9.8.12. Any hose reel installed in such building shall comply with the requirements contained in ISO 4642-1.

3.9.8.13. Any hose reel so installed shall be positioned to ensure that the end of the hose will reach any point in the area to be protected.

3.9.8.14. Any hose reel installed in any building shall bear, in a prominent position on the reel disc facing the user and the mark of standardization relative to the requirements of institution in charge of standard.

3.9.8.15. Where a satisfactory water supply and pressure are not available, two fire extinguishers shall be provided in place of each required hose reel.

3.9.8.16. The fire equipment and hose connected to supply the system shall not block access to the buildings for other fire equipment. Their inlet shall not be less than 45 and /or 75mm.

3.9.8.17. Fire department connections shall be equipped with plugs or caps to prevent dirt and other foreign objects from entering the piping. It is important to replace broken or missing caps to maintain the connections in working order.

SECTION 9: FIRE INSTALLATIONS

3.9.9.1. APPROVED FIRE INSTALLATIONS

3.9.9.1.1. Every approved fire installation shall be linked to a communication pipe supplied by the local authority. However, the Building Consent Authority may, subject to any conditions it may consider necessary, allow such fire installation to be connected to approved alternative source of supply or source of non-potable water.

3.9.9.2. DESIGN OF FIRE INSTALLATIONS

3.9.9.2.1. In every fire installation, acceptable pumping connections and means of measuring water pressure shall be provided.

3.9.9.2.2. In every fire installation, isolating valves shall be provided to regulate the flow of water to the installation, and to point within the installation, as the approving Authority shall be required.

3.9.9.2.3. In every fire installation, the quantity, pressure and rate of flow of water shall be satisfactory for the supply of any hose reel, hydrant or sprinkler system.

3.9.9.2.4. Every fire installation furnished with automatic pump starting mechanisms shall be fitted with an alarm system designed to emit a continuous audible warning whenever and for so long as any pump installed in the installation is set in motion.

3.9.9.2.5. Every fire installation furnished with manual pump starting mechanisms shall be kept constantly charged with water and shall at all times be under-the supervision and control of a person who is fully knowledgeable with all the technical details of the installation and its warning devices.

3.9.9.2.6. Every alarm system shall be provided with an alarm cancel button.

3.9.9.2.7. Every pump unit and its starting and driving mechanisms shall be installed in a ventilated compartment constructed to have a fire resistance rating of not less than 2 hours and wherever every compartment is located at or below ground level, the means of access shall be adjacent to a street, public place or an open area on the site. Whenever such compartment is located in a basement, the means of access thereto shall be enclosed by walls having a fire resistance rating of not less than 2 hours and shall not be used as a means of access to any other part of the building.

3.9.9.2.8. Every fire installation shall be thus erected as to provide:

(i) The quantity of water satisfactory for the operative operation of that number of hose reels, hydrants and sprinkler heads which may be operated or come into operation simultaneously in every division; and

(ii) Flow pressure, at any hose reel or hydrant, of not less than 300kN/m^2 and a flow rate of not less than:

a. 0.5 litres per hose reel; and

b. 20 litres per hydrant.

(iii) Flow pressure and flow rate at the control valve of any sprinkler system suitable to the hazard rating of such system.

3.9.9.2.9. In every fire installation; the nominal diameter of:

(i) Every communication pipe serving such installation shall be not less than 75mm;

(ii) Every pipe distribute water to any fire hydrant shall be not less than 75mm; Provided that where the length of such pipe is more than 50m the nominal diameter of such pipe and of the communication pipe to which the installation is connected shall be not less than 100mm;

(iii) Every service pipe distributes water to any hose reel on any one floor of a building shall be not less than:

a. 25 mm, if it serves 1 or 2 hose reels;
b. 32 mm, if it. Serves 3 hose reels;
c. 40 mm, if it serves 4 or 5 hose reels;
d. 50 mm, if it serves more than 5 hose reels.

(iv) Every pipe which serves any hydrant and hose reel installation or an automatic sprinkler installation, shall be provided with an identical pumping connection;

(v) Every pipe which serving only hoses reels shall be provided with a single pumping connection; and

(vi) Every pipe fitted with one or more fire-pump connections shall be fitted with a pressure gauge reading up to 2500kN/m^2 and a reflux valve so located as to shut off automatically the direct supply of water from the local authority system to such installation whenever and for so long as any such fire pump connection is in use.

3.9.9.2.10. No reflux valve in any fire installation shall be so positioned as to prevent or hinder the flow of water from any fire-pump connection to any hose reel or hydrant connected to such installation.

3.9.9.2.11. Every fire installation shall be connected:

(i) Directly to the communication pipe where the local water supply can provide the rate and pressure of flow requested for hose reels; and

(ii) To a storage tank of satisfactory capacity where thus requested by the approving Authority or where the local Authority‘s water supply is not capable of providing such pressure and rate of flow.

3.9.9.3. FIRE SAFETY INSTALLATIONS

3.9.9.3.1. The proprietor/tenant of a building shall make sure that maintenance of every fire safety installation for the building is carried out by a suitably skilled person.

3.9.9.3.2. The proprietor/tenant of a building shall make sure that every fire safety installation for the building is inspected and tested at intervals.

3.9.9.3.3. If the record of maintenance for a fire safety installation for a building shows that the corrective action is required for the installation, the proprietor of the building shall make sure that the corrective action is taken not later than 1 month after the maintenance of the installation was carried out.

3.9.9.3.4. The proprietor/ tenant of a building shall formulate a statement that complies with the part about the maintenance of each prescribed fire safety installation for the building.

3.9.9.3.5. The proprietor/ tenant of an accommodation building for which a fire safety management plan is necessary shall keep:

(i) The record of maintenance for the building; and
(ii) The tenant statements prepared for the building.

3.9.9.4. SUPPLY OF WATER

3.9.9.4.1. Water shall not be taken from a supply system for use in any fire installation, unless request has been submitted to the local authority for the supply of such water and such request has been approved.

3.9.9.4.2. Storage tank shall be related, delivered with water and controlled in accordance with the following necessities:

(i) The connection among such storage tank and any supply pipe shall be above the level of the outlet of the topmost hose reel; and

(ii) Storage tank shall be delivered with water in a way satisfactory to fill and to maintain it automatically to its required capacity except when any hose reel connected to it is in use, and where the supply of water is controlled by a ball valve, such valve shall have a diameter of not less than 20mm and shall be fitted with a manually operated shut-off valve.

3.9.9.4.3. Wherever in every fire installation, every hydrant valve or hose reel is installed at a height greater than that at which the authority can maintain a satisfactory water supply from its water supply system or through the equipment of its Fire department, such installation shall:

(i) Be capable of maintaining a flow rate of not less than 20 litres at a gauge pressure of not less than 300kPa at any hydrant valve connected to such fire installation;

(ii) Be provided with; A tank located at or below ground level which shall:

a. Have a capacity of not less than 25,000 litres;
b. be supplied by a service pipe which has a diameter of not less than 20mm and is connected to a communication pipe and provided with a pressure gauge reading up to 2,500kPa, controlled at its outlet by a high-pressure automatic shut-off valve;
c. be linked to an additional service pipe which has a diameter of not less than 100mm, a twin fire-pump connection fitted at its inlet and an outlet so positioned as to discharge into the top of the tank;
d. be provided with a gauge to indicate the level of water contained in the tank

(iii) Be driven by an electric motor connected to the normal electric power supply and to a diesel-electric unit which shall start automatically and immediately in the event of failure of the normal electric power supply; and

(iv) Be connected to a delivery pipe having a diameter of not less than 100mm, or not less than 150mm in the case of any delivery pipe which exceeds a height of 50m above the pump.

3.9.9.5. COMMUNICATION PIPE

3.9.9.5.1. Every fire installation shall be linked to a communication pipe provided by the local water authority and located at a position and depth to be determined by the approving Authority.

3.9.9.6. WATER METER

3.9.9.6.1. Water meter shall be provided in every fire installation by the local water authority.

3.9.9.7. ISOLATING VALVES

3.9.9.7.1. An isolating valve shall be fitted in any fire installation at a position not more than 1.5m inside the boundary of the site.

3.9.9.8. FIRE COMMAND CENTRE

3.9.9.8.1. LOCATION

3.9.9.8.1.1. Wherever required in buildings and construction, a fire command center for fire department operations must be provided**.** The place and accessibility of the fire command center shall be approved by the fire department and the designer.

3.9.9.8.1.2. The fire command center shall be separated from the remainder of the building by not less than an hour fire barrier constructed in accordance with horizontal assembly.

3.9.9.8.1.3. A layout of the fire command center and all features required by this section to be contained therein shall be submitted for approval prior to installation

3.9.9.9. SUGGESTED ARRANGEMENT

3.9.9.9.1. A Fire Command Centre should be established in:

(i) High-rise buildings;
(ii) Underground establishments that manages public transport;

(iii) Industries;

(iv) Middle-rise buildings that manages patient confined to bed;

(v) Oil refineries; and

(vi) Building contaminant

3.9.9.9.2. EQUIPMENT NOT PERMITTED WITHIN A FIRE COMMAND CENTER

3.9.9.9.2.1. Some equipment like pumps, pipes sprinkler control valves, an internal combustion engine and pipe fittings must not be located in a fire control Centre but may be located in rooms accessed through the fire control Centre.

3.9.9.9.2.2. The external face of the door to the fire control room must have a sign with the words “FIRE COMMAND CENTER” or **“**FIRE CONTROL ROOM” in letters of not less than 50mm high and of a colour which contrasts with that of the background.

RWANDA BUILDING CODE

Chapter Three:
FIRE SAFETY

PART 10:

REQUIREMENTS FOR ACCESSIBILITY & EVACUATION

SECTION 1: GENERAL MEANS OF EGRESS
SECTION 2: EVACUATION
SECTION 3: REQUIREMENTS FOR USE OF BUILDINGS FOR PERSONS WITH DISABILITIES

PART 10: REQUIREMENTS FOR ACCESSIBILITY& EVACUATION

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PART 10: REQUIREMENTS FOR ACCESSIBILITY & EVACUATION

SECTION 1: GENERAL MEANS OF EGRESS

3.10.1.1. EXIT AND DOORS ACCESS

3.10.1.1.1. Means of egress from dwelling units or sleeping areas shall not lead through other sleeping areas, toilet rooms, bathrooms, storage rooms or kitchens. Exit requirements and personal hazards shall comply with RS 186-5

3.10.1.1.2. The exit doors shall be readily openable from the egress side without the use of a key or special knowledge or effort and emergency lighting shall be provided.

3.10.1.1.3. Exterior exit doors shall lead directly to the exit discharge or the public way.

3.10.1.1.4. Where the occupants of any room are not more than 25 persons, the clear width of any exit door shall be not less than 0.90m.

3.10.1.1.5. A boardroom, lecture room or classroom that has a population of more than 50 persons or any other room that has a population of more than 25 persons shall have not less than two exit doors, and such doors shall open in the direction of travel along the escape route with an aggregate width of not less than the required width for an escape route for such population, in accordance with the measure of the travel distance.

3.10.1.1.6. Where two or more exit doors are required, they shall be positioned as far apart as is practicable, but not closer than 5m from each other.

3.10.1.1.7. where the occupancy is classified as A-1, A-2, A-3, A-4, I-2, I-3, M-1 or M-3 an exit door of any room shall open in the direction of travel along the escape route, provided that in any occupancy classified as E-1 where the population of the room is less than 50 persons, such door may open into such room against the direction of travel along the escape route.

3.10.1.2. ACCESS TO BUILDINGS FOR FIRE-FIGHTING AND SALVAGE PURPOSES

3.10.1.2.1. Not any construction shall be erected on any site unless such site is provided with suitable access for the purposes of fire-fighting in and salvage from such construction by the Fire Services of the Authority.

3.10.1.2.2. Every escape door shall be clearly branded from the exterior of the building.

3.10.1.2.3. The number of any floors shall be indicated inside any emergency route on any access door.

3.10.1.2.4. All buildings shall be provided with access to their interior for rescue and fire-fighting purposes by such services.

3.10.1.2.5. The requirements of sub-regulation 3.10.1.3.4 shall not apply to any portion of a building which is to be used for the purposes of a normally unoccupied strong room, record room or security vault.

3.10.1.3. SIGNPOSTING AND MARKING

3.10.1.3.1. All building that has escape routes shall be clearly marked and signposted to direct the direction to be travelled in the case of any emergency.

3.10.1.3.2. All characters, symbols and marks used shall be:

(i) International and visual; and
(ii) Internal and external illuminated with intensity not less than 50 lux.

3.10.1.3.3. Over any exit doors of any hall or auditorium shall be display “EXIT” with a height not less than 0.15m.

3.10.1.3.4. In the case of occupancies classified as A-2,I-1,I-2,I-3or in any building normally occupied during the hours of darkness, such marks or signs shall, in the event of the failure of the normal mains supply, be so illuminated for not less than 2 hours. And the emergency power supply to the lighting of such marks or signs shall be protected against the effects of fire for a period of not less than 2 hours.

3.10.1.3.5. In order to insure the safety of occupants, the local authority may require the provision of signs prohibiting exit.

3.10.1.3.6. The exit door mark is not required when used as normal egress and for a room which has a population less than 25 persons.

SECTION 2: EVACUATION

3.10.2.1. EVACUATION PLANNING REQUIREMENTS

3.10.2.1.1 Emergency evacuation plans of building occupants shall be prepared in advance and all occupants must be well fitted in the operation of such plan.

3.10.2.1.2 Evacuation plan shall include:

(i) The action to be taken by the person discovering a fire;
(ii) The action to be taken for evacuation of the building and assuring accountability of the occupants;
(iii) The action to be taken pending the arrival of emergency services; and
(iv) An evacuation floor plan that identifies exit doors and windows.

3.10.2.1.3 Each building shall have an emergency evacuation diagram/ plan, that is simple to read in the event of fire or other hazardous materials emergency.

3.10.2.1.4 The evacuation plan of occupants who due to illness, injury or disability shall indicate the comfortable escape route in the event of an emergency.

3.10.2.1.5 Planning for evacuation of persons with visual impairments shall be included in the health and safety procedures and in regular evacuation exercises.

3.10.2.1.6 Any owner or occupier of a building shall ensure the fire and evacuation plan for the building is kept in written form.

3.10.2.1.7 Any modification conducted to an existing building shall be accomplished in that manner that ensures conformity with all the safety requirements of the new buildings.

3.10.2.1.8 All alterations shall not, in any way, bring down level of fire and life safety below that which existed earlier. Any addition or alterations or construction of dividing

for floor area exceeding 500m^2 for all high rise buildings shall be with approval of local fire department.

3.10.2.2. THE LOCATION OF EVACUATION PLANS AND SIGNS

3.10.2.2.1. Every building shall have emergency evacuation plan on each floor and shall be clearly marked and signposted to indicate the direction to be travelled in the case of any emergency.

3.10.2.2.2. A suitable and approved emergency plan and evacuation route should be affixed to the back of every room door of building.

3.10.2.2.3. Emergency evacuation route signs shall be located high up against walls or hang from ceilings.

3.10.2.2.4. At any landing of stairway or escalator system a sign shall be displayed indicating the direction of at least one of the escape routes.

3.10.2.2.5. Any mark or sign contemplated in this Code shall comply with the requirements of sub-regulation 3.10.1.3.3.

3.10.2.2.6. When any building is occupied, any mark or sign shall be illuminated in accordance with sub- regulation 3.10.1.3.2.

3.10.2.2.7. In the case of occupancies classified A2, I-1, I-2, I-3 or in any building normally occupied during the hours of darkness and having a population exceeding 100 persons, the marks or signs shall in the event of the failure of the normal mains supply be illuminated for not less than 2 hours.

3.10.2.2.8. The emergency power supply to the lighting of such marks or signs shall be protected against the effects of fire for a period of not less than 2 hours.

3.10.2.3. EVACUATION/ESCAPE ROUTES REQUIREMENTS

3.10.2.3.1. All buildings must be provided with one or more escape routes that can be used in case of fire or other emergencies. The route should at all points, be wide enough to allow the persons using such route to move rapidly along it and it must not, at any time, be obstructed in any way.

3.10.2.3.2. Any wall enclosing an emergency route shall have a fire resistance of not less than 2 hours or the relevant time required for stability of structural elements or components given in Table 3.10.2-1.

3.10.2.3.3. Any floor or ceiling of emergency route shall have a fire resistance of not less than 2 hours or the relevant time required for the stability of structural elements or component as Table 3.10.2-2.

3.10.2.3.4. The finish of the floor of any escape route shall have a slip resistant surface, shall be free from any projections, indentations, hollows or covering which may cause a person to trip.

3.10.2.3.5. The last component of any emergency route shall discharge at ground level directly to a street or public place or to an approved open air space leading to a street or public place.

3.10.2.3.6. Any access door or any other door, being a component of emergency route shall be a hinged door which shall open in the direction of egress from the building.

3.10.2.3.7. Any revolving or sliding door or automatically operated door or shutter shall be equipped with an approved fail-safe system and there shall be an adjacent alternative hinged door which shall comply with all regulations relating to hinged doors in emergency routes.

3.10.2.3.8. The width of any escape route within any room having a population of more than 25 persons shall be not less than 800mm.

3.10.2.3.9. The width of any part of an escape route between any exit door and the end of such route shall be not less than 1.1m.

3.10.2.3.10. Any escape route shall be provided throughout its length width clear headroom of 2m and in any lobby, foyer or vestibule the minimum room height shall be not less than 2.4m.

3.10.2.3.11. In any building the width of any escape route to be provided in respect of any room, storey or portion shall be not less than that given in Table 3.10.2-3 for the population concerned.

3.10.2.3.12. No individual escape route shall be designed for a population of more than 200 persons.

3.10.2.3.13. Where there are two or more emergency routes, such route shall be discounted in determining the widths required for the remainder.

3.10.2.3.14. The regulations given for the sitting and dimensioning of escape routes shall apply essentially to in any design for fire protection measures in a shopping mall. The larger shops in a shopping mall shall have escape routes independent of those provided for the remainder of the mall.

3.10.2.3.15. The simultaneous evacuation route from all parts of the stadium shall be considered and it shall be possible to consider alternative means of escape.

3.10.2.3.16. Every building of a height of more than three storeys shall be provided with not less than two escape routes. Any such emergency route shall include any stairway forming part of the escape route and also that part of the escape route from the lower end of the stairway to any escape door.

3.10.2.3.17. Every building which is not classified in building occupancy F-4 or R-5 and storey below the ground storey shall be served by not less than two separate emergency route stairways.

3.10.2.3.18. All building shall be inspected by a qualified person from the Authority; to check if they fulfill the evacuation requirements before being occupied or used for any purpose and shall comply with ISO 23601.

3.10.2.3.19. A number of exits required in the escape routes in buildings shall comply with the provisions of Table 3.10.2-4 below:

Table 3.10.2-1: Stability of Structural Elements or Component

S/N	Occupancy	Class of Occupancy	Stability (minutes)				
			Single Storey Building	Double Storey Building	3-10 Storey Building	11 Storey Building and Over	Basement in any Building
1	Entertainment and public assembly	A-1	30	60	120	120	120
2	Theatrical and indoor sport	A-2	30	60	120	120	120
3	Places of instruction	A-3	30	30	90	120	120
4	Worship	A-4	30	60	90	120	120
5	Outdoor sport	A-5	30	30	60	90	120
6	High risk commercial service	B-1	60	60	120	180	120
7	Moderate risk commercial service	B-2		60	120	120	120
8	Low risk commercial service	B-3	30	30	90	120	120
9	Exhibition hall	A-1	60	90	120	120	120
10	Museum	A-2	30	60	90	120	120

11	High risk industrial	F-1	60	90	120	180	240
12	Moderate risk industrial	F-2	30	60	90	120	180
13	Low risk industrial	F-3	30	30	60	120	120
14	Plant room	F-4	30	30	60	90	120
15	Places of detention	I-1	60	60	90	120	120
16	Hospital	I-2	60	90	120	180	120
17	Other institutional (residential)	I-3	60	60	120	180	120
18	Large shop	M-1	60	90	120	180	120
19	Small shop	M-2	30	60	120	180	120
20	Wholesalers' store	M-3	30	90	120	120	120
21	Offices	B-3	30	30	60	120	120
22	Hotel	R-1	30			120	120
23	Dormitory	R-2	30			120	120
24	Domestic residence	R-3	30			120	120
25	Detached dwelling house	R-4	30			N/A	120
26	High risk storage	S-1	60			1 80	240
27	Moderate risk storage	S-2	30			120	180
28	Low risk storage	S-3	30			90	120
29	Parking garage	S-4	30			90	120

Table 3.10.2-2: Fire Resistance of Occupancy and Division Separating Elements

S/N	Occupancy	Fire Resistance (minutes)
1	All building occupancies class other than those referred below.	60
2	A-1, B-1, F-1, I-1, I-2, I-3, M-1, M-3, S-1	120

Table 3.10.2-3: Width of Escape Routes

S/N	Maximum Number of Persons	Maximum Width (mm)
1	120	1100
2	130	1200
3	140	1300
4	150	1400
5	160	1500
6	170	1600
7	180	1700
8	190	1800
9	200	1900

Table 3.10.2-4: The Minimum Number of Escape Routes per Number of Population

S/N	Population in Building	Exits
1	Up to 200	2
2	200-300	3
3	300-400	4
4	400-550	5
5	550-700	6
6	700-850	7
7	850-1000	8
8	1000-1500	9
9	1500-2000	10
10	Over 2000	10+1 for each 500 additional

3.10.2.4. STAIRWAYS CONSIDERATIONS

3.10.2.4.1. At any storey level, the entrance to any stairway forming part of an emergency route shall not be closer than 5m to the entrance to any other such stairway.

3.10.2.4.2. Any stairway forming part of an emergency route shall discharge into a corridor or foyer forming part of such emergency route or into a street, public place or approved open space.

3.10.2.4.3. Any stairway forming part of an emergency route from any storey above ground level shall not have direct access to any basement.

3.10.2.4.4. No escalator shall form a component of any emergency route.

3.10.2.4.5. Where any stairway forms part of an emergency route such stairway shall, throughout its length, be provided with a handrail on each side.

3.10.2.4.6. The width of any stairway forming part of an emergency route shall be not less than that given in Table 3.10.2-3 for the population concerned and such width shall be not more than 1.9m.

3.10.2.4.7. The distance between any change in floor level and the centre line of a doorway in an emergency route or between two changes of floor level in such route shall be not less than 1.5m.

3.10.2.4.8. No curved or winding stairs shall form part of any emergency route.

3.10.2.4.9. Any change in the level of the floor of any emergency route other than by a stairway between levels shall be effected by means of a ramp or steps:

(i) No such ramp shall have a slope exceeding 1 in 8; and
(ii) In the case of steps, not less than three steps shall be provided.

3.10.2.4.10. No external stairway shall be permitted to be a component of any emergency route of any building which exceeds 18m in height unless such stairway is, subject to the requirement of the ventilation.

3.10.2.4.11. No window, door or other unprotected opening in any facade of a building shall be closer than 3m to any access door or any open stairway forming part of an escape route.

3.10.2.5. VENTILATION OF STAIRWAYS IN AN EMERGENCY ROUTE

3.10.2.5.1 Any enclosed stairway which a component of any emergency route in any building is not exceeding 30m in height shall be provided with a window or other opening not less than $1m^2$ in area for ventilation to the outside of the building at each storey level.

3.10.2.5.2 The enclosed stairway which can be used as emergency route in any building not exceeding 30m in height shall be ventilated by means of a roof ventilator having an effective area of not less than 25% of the plan area of the stairwell and such ventilator shall be permanently open.

3.10.2.6. LIGHTING OF FEEDER AND EMERGENCY ROUTES

3.10.2.6.1. Any emergency route shall be provided with artificial lighting complying with ISO 30061 and at any time when the building containing such route is occupied there shall be a minimum luminance of 50 lux on a horizontal plane 100mm above the floor.

3.10.2.6.2. In any building having a population of more than 100 persons an adequate number of emergency light sources shall be installed along such emergency route and such light sources shall be connected to emergency power supply which is independent of the mains supply and capable of providing power supply to such emergency light sources for not less than 60 minutes.

3.10.2.6.3. Any feeder route in any basement or in any building classified A1, A2, A3, A4, I-2, I-3, M-1, M-3 or R-3, shall be provided with emergency lighting. In any occupancy classified in A3 having a population of less than 50 persons, such feeder route shall not be required to be provided with such lighting.

SECTION 3: REQUIREMENTS FOR USE OF BUILDINGS FOR PERSONS WITH DISABILITIES

3.10.3.1. RAMPS FOR PERSONS WITH DISABILITY

3.10.3.1.1. Design of facilities of people with disabilities shall be done in accordance with the provisions given in this code in conjunction with the requirements of RS 155

3.10.3.1.2. For fire protection considerations, where there is level difference, ramps shall be provided to avoid the curbs and to permit the physically challenged persons to access the area.

3.10.3.1.3. RAMPS SHALL BE DESIGNED AS FOLLOWS:

(i) Ramps shall be not less than 1.5m wide;

(ii) A space not less than 1.5m square shall be provided at the head and foot of every ramp;

(iii) Where a ramp is at a gradient of 1 in 20 or steeper, a landing 1.5m long shall be provided for each 10m of horizontal run or part thereof;

(iv) Any ramp with a rise greater than 0.2m, leading down towards an area where vehicular traffic is possible, shall have a railing across the full width of its lower end, not less than 1.5m from the foot of the ramp;

(v) No ramp shall be at a gradient exceeding 1 in 12%; and

(vi) All ramps shall be provided with handrails on both sides. Supports shall not cause an obstruction to a height of 0.7m above ramp level.

3.10.3.2. DROPPED CURBS FOR PERSONS WITH DISABILITY

3.10.3.2.1. To ensure the safe passage of persons with disabilities, the dropped curb shall be used where there are changes in level at curbs. Dropped curbs shall be provided at pedestrian crossing and at each end of the footpath of a private street or access road.

3.10.3.2.2. Dropped curbs shall also be used at the separation of ramps from vehicular areas to enable the passage of wheelchairs users and other persons with physical challenges. Dropped curbs shall be constructed as follows:

(i) The length of dropped curbs shall be not less than 1.2m;
(ii) The pavement at dropped curbs shall be ramped at a gradient of less than 1 in 6% and there shall be a space of not less than 0.8m wide at the back of the ramp; and
(iii) Curbs adjoining dropped curbs shall be ramped at a gradient of less than 1 in 6%.

3.10.3.3. LIFTS FOR PERSONS WITH DISABILITY

3.10.3.3.1. Accessibility on entrance or use and/or exit shall be provided to every floor of a multi-storey building by at least one lift having:

(i) Minimum internal car dimensions of 1.2m by 1.1m wide; with a clear door width when opened of not less than 0.9m;
(ii) Essential lift control buttons or switches not less than 0.9m and not more than 1.2m above the floor of the car; and
(iii) Handrails extending to within 0.15m of the corners at the rear and sides of the car which are suitable for use by the persons with disability.

3.10.3.4. DOORS SPECIFICATION FOR FIRE PROTECTION FOR PERSONS WITH DISABILITY

The dimensions of doors for accessibility and use of building by the persons with disability shall comply with the following specifications:

(i) Doors shall have a clear width of not less than 0.75m between the open door and opposite jamb or other leaf;

(ii) The unobstructed area adjacent to the door handle on the leading face of a single door shall not be less than 0.38m wide;

(iii) Doors, if less than 0.38m from the corner of a room, shall swing from the side nearer that corner;

(iv) Double-action self-closing doors shall have a check mechanism to prevent the doors swinging beyond the closed position and transparent panel with the bottom edge not more than 1m and the top edge not less than 1.5m above floor level;

(v) Door handles shall be not less than 0.9m and not more than 1.05m above floor level, measured from the top surface of the grip; and

(vi) Door thresholds shall not exceed 25mm in height.

3.10.3.5. HANDRAILS FOR PERSONS WITH DISABILITY

In order to ensure safety during the escape of fire;

3.10.3.5.1. Handrails to ramps and stairs shall be fixed not less than 30mm and not more than 50mm clear of walls and alternatively other obstructions and with a clear height of 70mm from the top of the bracket to the top of the handrail.

3.10.3.5.2. The tops of handrails shall be of a height of not less than 850mm or more than 1m above nosing, floor or landing level.

3.10.3.5.3. Handrails shall extend horizontally not less than 0.3m beyond the first and last nosing of every flight of steps or beyond the ends of a ramp.

3.10.3.5.4. Additional requirements for handrails shall be dimensions in according with RS 115-2011

3.10.3.6. WHEEL CHAIR SPACES

3.10.3.6.1. The wheel chair users shall be considered in order to be protected during fire attack, therefore the area of every building which is a place of public function such as entertainment at spectator level shall be provided with one-wheel chair space for every 400 or part of 400 seats in the auditorium.

3.10.3.6.2. For the purposes of this regulation a wheel chair space shall be taken as a rectangle of 0.76m by 1.37m with a side of 0.76m being toward the stage, podium or screen.

3.10.3.6.3. Wheel chair space shall be designed and availed in conformity with relevant parts of ISO 7176being toward the stage, podium or screen.

3.10.3.7. ROOMS FOR THE PERSONS WITH DISABILITY

For safety of persons with disabilities during fire, the hotel or motel with 100 guest rooms or more shall provide not less than 2 guest rooms with full facilities for the persons with disability and a further room for every complete 100 guest rooms in excess of 200.

REPUBLIC OF RWANDA

CHAPTER 4:

GENERAL PROVISIONS

RWANDA BUILDING CODE

Chapter Four:
BUILDING SERVICES

PART 11:

BUILDING SERVICES REQUIREMENTS

SECTION 1: ENERGY EFFICIENCY
SECTION 2: LIGHTING & VENTILATION
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PART 11: BUILDING SERVICES REQUIREMENTS

SECTION 1: ENERGY EFFICIENCY

4.11.1.1. GENERAL REQUIREMENTS

4.11.1.1.1. The buildings shall be designed, constructed and operated so as to ensure a good indoor environmental quality with a minimum use of non-renewable energy. New Buildings shall be assessed for energy efficiency in accordance to ISO 23045.

4.11.1.1.2. The thermal comfort shall be provided through passive building measures wherever possible and the use of the artificial cooling or heating shall be minimised.

4.11.1.1.3. Indoor environmental quality shall be ensured first by the quality of construction materials and source control; and by proper ventilation. Ventilation should use natural means (wind and stack effect). Mechanical ventilation shall be used only where and when necessary.

4.11.1.1.4. Day lighting shall be used at the optimum level, and the buildings shall be designed and constructed to promote natural lighting.

4.11.1.1.5. All appliances using non-renewable energy should be among the best energy efficient appliances.

4.11.1.2. ENERGY EFFICIENCY IN BUILDINGS

4.11.1.2.1. The below buildings of categories 4 and 5 shall be mandatorily subjected to the provisions of Rwanda Green Building Minimum Compliance system in conjunction with approved and International standards. All other remaining categories can comply on a voluntary basis. Refer annex 3 to understand the requirements of Rwanda Green Building Minimum Compliance system applicable on:

- Commercial buildings (excluding warehouses and retail shops)

- Public administrative and institutional buildings (excluding correctional services, police, fire department)
- Social, cultural & assembly buildings
- Health facilities
- Educational buildings (excluding living areas for students)

4.11.1.2.2. The building envelope within which internal air temperature and/or humidity is to be controlled shall be designed and constructed to perform the following:

(i) Provide adequate rates of ventilation and means of ventilation control; and

(ii) Minimize excessive solar heat gains through suitable building orientation and the use of suitable building external shading design and construction features.

4.11.1.2.3. Design of buildings shall be done in way to maximize natural ventilation by advocating for a better window design, the use of mixed mode of ventilation and by selecting energy efficient mechanical ventilation systems.

4.11.1.2.4. Cooling in buildings should be kept at its optimum level by controlling solar gains through glazing, reducing internal heat gains, making sure of thermal mass and night ventilation to reduce peak temperatures; these measures should be accompanied by a necessary increase in natural ventilation for a maximum result.

4.11.1.2.5. Building internal artificial lighting shall be reduced by maximizing use of day lighting and by limiting the installed load of artificial lighting devices. The use of energy efficient luminaries with a high output to energy ratio and provide a suitable means for any artificial lighting control shall improve the energy efficiency.

4.11.1.2.6. The illuminance for artificial lighting (in Lux) shall be adapted to the occupations at each location of the premises as shown in Table 4.11.1-1.

Table 4.11.1-1: Illuminance Required Per Type of Activity.

Group of Occupancy	Applications	Illuminance (Lux)
R	Bedroom	100
	Toilet	100
	Stores and staircases	100
	Lounge	150
	Bathroom	150
	Kitchen	150-300
A, B, E, I, S, MEM, MIX	Minimum service illuminance	20
	Corridor, passageways, stairs	100
	Entrance hall, lobbies, waiting room	100
	Escalators, elevator	150
	Restaurant, canteen, cafeteria	200
	Museum and gallery	300
	General offices, shops and stores, reading and writing	300-400
	Drawing office	300-400
	Class room, library	300-500
	Shop/ supermarket/ department store	200-750

4.11.1.2.7. For illuminance levels of various interior spaces refer to the table titled 'Lighting Power Desnity and Illuminace Levels' of Artificial lighting efficiency green building indicator of Rwanda green building minimum compliance system.

4.11.1.2.8. Where applicable in buildings that include any hot water systems for bathing or washing clothes, their design or construction shall be designed and constructed to minimize the energy used in the heating.

SECTION 2: LIGHTING & VENTILATION

4.11.2.1. GENERAL REQUIREMENTS

4.11.2.1.1. A room of any building shall have in the external walls an adequate number of openable windows that shall be of such size as to afford effective natural lighting and ventilation of the room by communication with external air.

4.11.2.1.2. The backup lighting shall be provided for periods when natural lighting is inadequate or where the size or shape of any such room or the glazing material used in any such opening will not permit enough natural light effectively.

4.11.2.1.3. An owner of a building, which will be used as factory, warehouse, workshop, or other workplace, shall provide adequate and efficient means of lighting and ventilation.

4.11.2.1.4. All windows intended for the purpose of lighting or ventilation shall open directly to external air, shall be glazed or provided with wooden shutters or other approved shutters, and shall have a total area of not less than 10% of the floor area of the room.

4.11.2.1.5. The Authority shall have the right to order the provision of additional window area in the case of a factory, workshop, or other workplace with respect to openable window area where a shop has one or more display windows.

4.11.2.1.6. An owner of a dwelling unit shall, in addition to any requirements of this Code, provide permanent ventilation opening to any habitable room, passageway, hall or stairway.

4.11.2.1.7. In the case of factory, workshop, or other workplace where a substantial amount of heat will be generated, a permanent roof ventilator with a total area of not least than 2% of the floor area of the factory, workshop or workplace shall be provided.

4.11.2.1.8. Notwithstanding the provisions of this Code, the Authority shall permit the installation of an approved artificial ventilation system in any factory, workshop, or places of public assembly where the artificial ventilation system has been designed by a qualified engineer.

4.11.2.1.9. All new buildings or alterations and extensions to existing buildings shall make provision for adequate natural lighting and natural ventilation.

4.11.2.2. THE DESIGN AND TESTING OF ARTIFICIAL VENTILATION SYSTEMS

(i) Any reasonable design of an artificial ventilation system shall be carried out by or under the supervision of a qualified person and such person shall certify that the system has been designed in total compliance with these regulations.

(ii) The owner shall at acceptable intervals of time submit to the Authority test reports indicating that any artificial ventilation system installed in terms of these Regulations is operating in the designed manner; and

(iii) Any plant forming part of an artificial ventilation system shall be so designed, located and protected to ensure it doesn't cause any danger or nuisance to the public. Inspection and servicing can be undertaken, and unauthorized persons cannot tamper with such plant.

4.11.2.3. NATURAL LIGHTING

4.11.2.3.1. The area of wall opening, inclusive of frames and glazing bars, shall be not less than 10% of the floor area of the room or rooms served by it, or 0.2m^2, whichever is the greater.

4.11.2.3.2. As the purposes of natural lighting a room is provided with one or more openings, such opening or openings shall be situated in an external wall, or in a suitable position in the roof of the building.

4.11.2.3.3. Where such opening is glazed it shall be glazed with transparent or approved translucent glazing material.

4.11.2.3.4. Natural light borrowed from adjoining room:

(i) Through a glazed panel or opening from an adjoining room shall be borrowed a natural light; and

(ii) The adjoining room with windows shall have an aggregate light transmitting area of not less than 10% of the combined floor areas of both rooms and shall be open to the sky or face a court or other space open to the sky or an open verandah or carport.

(iii) Every liveable room in any dwelling house or dwelling unit, or any bedroom in any building used for residential or institutional occupancy shall, notwithstanding the provision of artificial lighting, be provided with at least one opening for natural light.

4.11.2.4. NATURAL VENTILATION

4.11.2.4.1. For the purposes of natural ventilation, any room shall be provided with an opening(s):

(i) The location of any opening in relation to each other and to any internal doors to such room shall be such as to enable such room to be ventilated; and

(ii) The arrangement and sizes of such openings in a garage shall be such that the quantity of noxious fumes or gases in such garage does not exceed a safe limit.

4.11.2.4.2. Every such opening shall be either:

(i) An opening or door in an external wall;

(ii) An openable glazed window in an external wall or in a suitable position in the roof; and

(iii) An opening in the ceiling or at the top of an internal or external wall, connected directly to a vertical ventilating pipe.

4.11.2.4.3. The total area of any opening, door or openable glazed window shall be not less than 10% of the floor area of the room or 0.2m^2, whichever is the greater.

4.11.2.4.4. Extract Ventilation of habitable and non-habitable rooms without operable windows can be achieved through mechanical extraction, open flued heating appliances and passive stack ventilation. In all non-habitable room cases an air inlet should be provided in the form of a 10mm gap under the door.

4.11.2.4.5. Passive Stack Ventilation could be either natural stack, wind assisted by use of ventilation cowls, roof ventilators or mechanical extract ventilation.

4.11.2.4.6. Where the variants to natural ventilation are used, the passive ventilation design should be justified through 'air changes per hour' calculations that should be carried out by or under the supervision of a qualified environmental design consultant to the approval of the Authority.

4.11.2.4.7. The recommended Ventilation rates in Air Changes per Hour for Natural Ventilation are as indicated in Table 4.11.2-2.

4.11.2.4.8. Planting of tree in streets and in open spaces should be done carefully to take advantage of both shade and sunshine without handicapping the flow of natural winds.

4.11.2.4.9. The design of Building orientation shall comply with the requirement of major climate zone or factor for the purpose of natural ventilating of buildings.

Table 4.11.2-2 Requirements for Natural Ventilation

Building Type/Facility	**Recommended Ventilation Rates in Air Changes Per Hour (ACH)**
Broadcasting studios	6-10

Call centres		4-6
Catering (inc. commercial kitchens)		30-40
Communal residential buildings		0.5-1
Dwellings (inc. high rise dwellings)		0.5-1
Hotels (R-1)		10-15 for guest rooms with Ensuite bathrooms
High rise (non-domestic buildings)		4-6 for office areas Up to 10 for meeting rooms
Schools (E-1)		8 litres per person minimum by opening windows or vents.
Dark rooms (photographic)		6-8
Laboratories		6-15
Standards rooms		45-60
Transportation buildings		6 -ACH for car parks (normal operation) 10-ACH (fire conditions)
Toilets		Opening windows of area 1/20th of floor area or mechanical ventilation at 6 litres/s per WC or 3 ACH minimum for non-domestic buildings
Assembly Halls and Auditoria (A)		
	Using Displacement ventilation strategy	3-4
	Using High level mechanical ventilation strategy	6-10
Sports Centres		
	Fitness Centres	10–12
	Weight Training	10-12

	Squash Courts	4
	Ancillary Halls: -Sports -spectators	 15 3
	Changing rooms	10
	Reception, administration and circulation spaces	3
	Creche	3
	Refreshment and bar areas	Not less than 8
	Swimming pool	4-6 8-10 if extensive water features N-9
Hospitals and Health Care Buildings(I-2)		
	Toilets •General	 10
	• Ensuite	6
	Bathrooms •General • Ensuite	 10 6
	Dirty utility room	10
	Changing rooms	5
	Isolation rooms	10 minimum
	Delivery rooms	10 minimum
	Recovery rooms	15
	Treatment rooms	4 minimum

4.11.2.5. NATURAL LIGHTING AND VENTILATION OF ROOMS OPENING ONTO ENCLOSED BALCONIES, GALLERIES, VERANDAHS AND COURTS

4.11.2.5.1. Any room having an opening which opens onto any roofed and enclosed balcony, gallery or verandah shall be deemed to satisfy the requirements and:

(i) A portion of the outer wall of any such balcony, gallery or verandah has compliant openings and the area of such openings is at least 10% of the combined floor area of the room concerned and the balcony, gallery or verandah; and

(ii) Any such balcony, gallery or verandah is provided with doors or other openable areas having an area of at least 5% of the combined floor area of the room concerned and the balcony, gallery or verandah.

4.11.2.5.2. Where natural ventilation is required and the cover extends over more than one-third of any enclosed court, additional ventilation openings must be as shown in Fig 4.11.2-1(a) and (b) through the building.

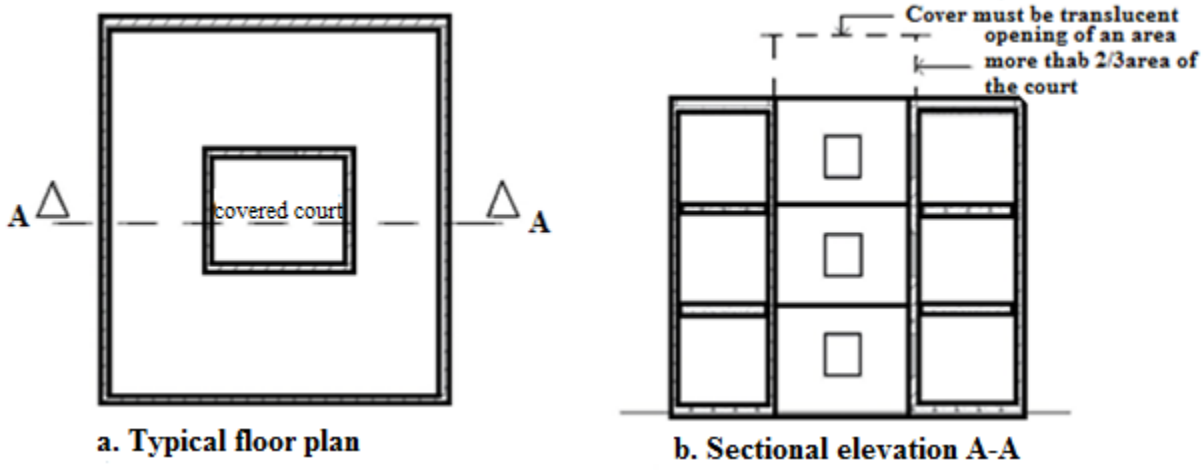

Fig 4.11.2-1 Lighting and Ventilation of Court

4.11.2.6. ARTIFICIAL LIGHTING

Where in any building the requirements for lighting are to be satisfied by the installation of a system of artificial lighting such lighting and the design requirements of indoor lighting quality shall be in accordance with ISO/CIE 8995-1 and ISO 16817 and other relevant standards published by the Government institution in charge of standards.

4.11.2.7. ARTIFICIAL VENTILATION

4.11.2.7.1. Outside air used in any artificial ventilation system shall be introduced to the system from an inlet positioned to ensure that such air is as far as possible free from local contamination.

4.11.2.7.2. Where it is not possible to so position such inlet a filter which will reduce contamination of such air to an acceptable level and prevent discharge into rooms of dust or fluff that has accumulated in ducts shall be fitted to such inlet.

4.11.2.7.3. The exhaust outlets for air which has been used for artificial ventilation purposes shall be so located and arranged as to ensure that such air does not cause a nuisance nor contaminate any air which is likely to be drawn into or ventilate any existing building.

4.11.2.7.4. Exhaust outlets or air inlets forming part of any artificial ventilating system shall be protected by a substantial grille or screen through which a 12mm diameter sphere cannot pass.

4.11.2.7.5. Where an artificial ventilation system has been connected to a room:

(i) Designed to be occupied by persons suffering from infectious or contagious diseases; and

(ii) Containing a WC pan or urinal or used as a sauna, darkroom or refuse storage room; air from such room shall not be re circulated to or permitted to pass into any other room, whether or not such room falls into the same occupancy category, and all such air shall be discharged or exhausted to the outside air.

4.11.2.7.6. Such room contemplated with heat, dust, gas, vapour or volatile matter is liberated in one or more localized areas, each such area shall be provided with an extract facility which shall exhaust air from such area at a rate that will ensure that such heat, dust, gas, vapour or volatile matter is effectively removed through such facility and discharged to the outside air.

4.11.2.7.7. The artificial ventilation system serving any parking garage shall be separate from any other artificial ventilation system: Provided that contaminated air exhausted from such garage may be circulated through a transformer, machine or similar service room in order to dissipate heat from machines before passing to the outside air.

4.11.2.7.8. The arrangement and sizes of air inlets and outlets in every garage required in terms of this part to be artificially ventilated shall be such as to ensure that the level of noxious or toxic fumes or gases at any location in such garage does not rise above a safe limit.

4.11.2.7.9. Where any kitchen contains an extraction facility for the purpose of extracting heat or vapour such facility shall, where it is to be subjected to an atmosphere containing grease in suspension, be fitted with a means which will filter the air entering such facility to prevent such grease being carried into the system: Provided that where such means cannot be fitted an easily accessible trap or settling chamber shall be installed in the duct leading from such facility.

4.11.2.7.10. Provision shall be made at every change in direction of such duct for easy inspection and for cleaning of the interior of the duct.

4.11.2.7.11. Any such extraction facility and the artificial ventilation system required therefore shall be constructed or lined throughout with a non-combustible material.

4.11.2.7.12. Any such extraction facility shall not be connected to any other extraction facility or artificial ventilation system.

4.11.2.7.13. Any self-contained artificial ventilation unit installed in the wall of any building where such wall abuts on a public street or place shall be installed and operated in such a way that condensate formed by the operation of the unit is prevented from dripping onto such street or place by means of:

(i) The use of a unit which disposes of all condensate by evaporation; or

(ii) Arranging for the condensate from the unit to be collected and disposed of into a drain or storm water drain or in such manner as will be acceptable to the Authority.

4.11.2.7.14. The arrangement and sizes of air inlets and outlets in any room which is artificially ventilated shall be such as to ensure an even and uniform distribution and circulation of air throughout the occupied zone of the room, without the creation of an air velocity of more than 0.5m/s within the occupied zone.

4.11.2.7.15. Any room or space which is required to be artificially ventilated and is used for an occupancy contemplated in column 1 of Table 4.11.2-3 shall be supplied with outside air at a rate not less than that contemplated in columns 2 and 4 of such table: Provided that:

(i) Where no figure is given in column 2, the rate given in columns 3 and 4 shall be used;

(ii) Where air has been re-circulated through an approved filter capable, of removing tobacco smoke particles, or the Authority is satisfied that smoking will not take place in such room or space or in any room or space from which the air has been recalculated, the rate may be reduced to that given in columns 3 and 4 of such table;

(iii) Where airborne toxic substances will be released into the room or space concerned, extract ventilation which is able to remove such substances shall be provided;

(iv) In the case of a kitchen or any room containing a bath, shower, WC pan or urinal in any dwelling unit or private dwelling house or any such room

serving any bedroom, borrowed air may be used in lieu of outside air and the system shall be capable of supplying the required quantity of air under conditions of intermittent use;

(v) In the case of any motor car repair garage, photographic darkroom, working area in a commercial dry-cleaning establishment, private or central kitchen in a hotel, motel, resort, dormitory and similar facilities or any wash-room or room containing a WC pan or urinal located in an office-type occupancy or intended for use by the public, the extract ventilation quantity shall exceed the supply air quantity to ensure negative pressure in the area concerned;

(vi) In the case of any laboratory, any fume cupboard provided shall be-capable of removing all fumes, gas, vapour or volatile matter likely to be generated in such cupboard; and

(vii) In the case of a ticket kiosk situated in a parking garage, the air supply to such kiosk shall be sufficient to create positive pressure within the kiosk.

Table 4.11.2-3: Air Requirements for Artificial Ventilation

Occupancy	**Minimum Air Requirement (L/s)**		**Remarks**
	Smoking	Filtered or non-smoking	
Public halls			Air supply required per person
Assembly halls	7.5	3.5	
Churches	7.5	3.5	
Theatres (including lobbies and auditoria)	7.5	3.5	
Cinemas	7.5	3.5	
Dry-cleaners and laundries			Air supply required per person
Commercial dry-cleaners (working areas)	-	120.0	

Storage/collection area			
Laundries	7.5	5.0	
	7.5	5.0	
Educational buildings			
Classrooms	-	7.5	Air supply
Laboratories	-	7.5	required
Libraries	-	6.5	per person
Food and eating facilities			
Dining-rooms and restaurants	7.5	5.0	Air supply
Cafeterias	7.5	5.0	required
Bars and cocktail lounges	7.5	5.0	per person
Kitchens	17.5	17.5	
Photographic darkrooms	-	10.0	Air supply required per person
Dwelling units			
Kitchens	50.0	50.0	
			Air supply
Other living areas	5.0	5.0	required
Bathrooms and shower-roams	25.0	25.0	per person
Rooms containing WC pan or urinal	25.0	25.0	
Shops			
Malls, arcades, warehouses	7.5	7.5	Air supply
Sales floors, showrooms, dressing rooms	7.5	7.5	required per room
Sports and amusement facilities	7.5	-	
Ballrooms and discos			
Bowling alleys (seating area)	7.5	-	
Playing area (gymnasium, etc)	-	10.0	

Locker-rooms Spectator areas Health spas and slimming salons	7.5 5.0 -	7.5 - 7.5	Air supply required per room
Occupancy	Minimum air requirement, L/s		Remarks
Garages Parking garages Ticket kiosks Motor car repairs	7.5 5.0 10.0	3.5 5.0 10.0	Air supply required per sq.m. Of floor area Air supply required per person Air supply required per sq.m. of floor area
Hotels, motels, resorts, dormitories and similar facilities Lobbies Conference rooms Assembly rooms Bedrooms Living-rooms (suites) Central kitchens Private kitchens	 7.5 7.5 7.5 7.5 7.5 17.5 50.0	 5.0 5.0 5.0 - - 17.5 50.0	Air supply required per person Air supply required per room
Offices General			Air supply required

Meeting and waiting spaces Conference and board rooms Cleaner's rooms	7.5 7.5 10.0 -	5.0 5.0 5.0 1.0	per person Air supply required per sq.m. of floor area
Libraries General Book stock	 - -	 6.5 3.5	Air supply required per person
Stages, TV, radio and movie film	7.5	5.0	Air supply required per person
Rooms containing baths, showers WC pans or urinals Serving a dwelling unit or any bedroom All others	25.0 20.0 7.5 5.0	25.0 20.0 7.5 - 5.0	Air supply required per room Air supply required per bath, shower,
			WC pan, urinal stall or 600mm of urinal space N-14
Transportation Waiting-rooms, ticket and baggage areas, corridor & gate areas, platforms, concourses	7.5		Air supply required per person

Smoking-rooms	20.0	-	Air supply required per person
Occupancies other than those listed above		As determined by The Authority	

4.11.2.8. WINDOWS

4.11.2.8.1. Any domestic building shall-be provided with approved means of ventilation and shall have a sufficient number of windows suitably positioned for direct communication with the external air.

4.11.2.8.2. Any habitable room shall have a window or windows opening directly into the external air, which shall have for the purpose of daylight, a total area exclusive of frames, equal to at least 10% of the floor area of such room.

4.11.2.8.3. For a window in a wall abutting on to an open verandah or immediately beneath a balcony or canopy, the minimum area required shall be increased by 5% for each 300mm that the verandah, balcony or canopy projects from the wall.

4.11.2.8.4. In habitable rooms windows shall be constructed so that an area thereof equal to at least one-twentieth of the floor area of the room shall be made to open to the external air, and part of the area so required to open shall not be less than 1.75m above the floor.

4.11.2.8.5. Provided that a window which opens from a habitable room on to an enclosed verandah, conservatory or similar place, shall be deemed to open directly into the external air if that room and that place are together provided with windows which open directly into the external air, and would suffice for the purposes of this sub regulation if they were the windows of a room having a floor area equivalent to the combined floor area of the first mentioned room and that place.

4.11.2.9. SPACE OPPOSITE WINDOWS

4.11.2.9.1. A window of a habitable room shall not be deemed to have direct communication with the external air unless there is opposite to such window for its entire area an unobstructed open space distant from:

(i) The plot boundary facing such window;

(ii) If such a boundary abuts on to a street or on to land designated as a public open space, the plot boundary on the opposite side of such street or land; and

(iii) If the window faces an internal open space contained entirely on the same plot as the building in which the window is situated, the wall on the opposite side of such open space, by an amount whereby the vertical face of the wall in which the window is placed does not intersect the theoretical plane created by an angle of 68 degrees from the horizontal and projected towards the wall from the aforementioned boundary or opposite wall at a height of 1.5m above the level of the floor of the room which the window serves: Provided that:

a. If adjoining plots are developed in such a manner as to allow for an internal open space, part of which is situated on each plot, the said theoretical plane may, if the Authority so agrees, be projected from the wall opposite side of that open space; and
b. In no case, shall the distance across an open space opposite a window of a habitable room be less than 2.5m.

4.11.2.10. BACK-TO-BACK DWELLINGS VENTILATION

4.11.2.10.1. All back-to-back dwellings shall be constructed in such a manner that every room shall have cross ventilation and adequate lighting.

4.11.2.10.2. If required by the Authority, every person who erects a building, shall cause every habitable room to have approved permanent air vents of sufficient number, so arranged as to ensure cross or through ventilation to the external air.

4.11.2.10.3. Air vents shall be placed at a height above the floor of not less than two-thirds of the average height of the room.

4.11.2.10.4. For the purpose of this Code, communication with the external air may be obtained through a ventilated corridor or passage which itself has an external wall through which adequate ventilation to the external air is provided, or the Authority may accept a flue communicating the room directly to the external air as one part of the means of providing through ventilation: Provided that, in all cases permanent ventilation shall be provided in one external wall.

4.11.2.11. LARDERS VENTILATION

Every pantry or larder shall be ventilated to the external air by an opening fitted with a fly-proof cover, so constructed as to allow adequate flow of air.

4.11.2.12. VENTILATION AND LIGHTING OF STAIRCASES

All common stairs and common passages shall be adequately cross ventilated, and for common stairs sufficient natural and artificial lighting shall be provided.

4.11.2.13. VENTILATION OF SHOPS

Where the light and ventilation of a shop into the external air is restricted to one wall, the width of such shop shall not, unless the Authority otherwise agrees, be less than half the depth and approved through-ventilation provided.

4.11.2.14. GARAGES CONNECTED TO A DWELLING

4.11.2.14.1. There shall be no communication between a habitable room' and a garage except through a passage, ventilated to the satisfaction of the Authority.

4.11.2.14.2. A garage connected to a habitable room through a passage shall be provided with permanent through-ventilation by means of vents at a height of 450mm above the floor level of the garage.

4.11.2.15. VENTILATION AND LIGHTING OF BUILDINGS OF THE WAREHOUSE CLASS

4.11.2.15.1. Every part of a building of the warehouse class, used for human occupation, shall be provided with lighting and ventilation to a standard not less than that required for a habitable room. Provided that:

(i) Nothing in this Code in respect of lighting and ventilation, shall exclude the provision of approved artificial lighting and mechanical ventilation; and

(ii) If an approved mechanical ventilation and artificial lighting system is installed, The Authority shall relax the requirements of this Code relating to the height of rooms and the requirement as to windows.

4.11.2.16. LIGHTING AND VENTILATION OF PUBLIC BUILDINGS

4.11.2.16.1. Except, as otherwise provided for in this Code, every public building shall be provided with adequate means of lighting and ventilation to a standard not less than that prescribed for a domestic building.

4.11.2.16.2. In foyers, shopping malls etc. where large numbers of people are expected to gather and not spaces principally used for circulation, ventilation shall be achieved through natural ventilation by appropriately located openings to external walls with a total area of 2% of the floor area.

4.11.2.16.3. In public spaces mechanical ventilation shall be designed to provide a ventilation rate of 1 liter/sec/m^2 of floor area.

4.11.2.16.4. All external glazed areas including windows, other wall glazed areas, atriums and other roof glazed areas should be fully sun-shaded against direct sun rays from 7:00 AM to 8:00 PM throughout the year.

4.11.2.17. DESIGN, CONSTRUCTION AND INSTALLATION OF SPACE HEATING

4.11.2.17.1. Lighting and ventilation of space heating shall comply with the requirement of design, construction and installation in accordance withISO 11855.

4.11.2.18. VENTILATION OF SPECIALIST ACTIVITIES

4.11.2.18.1. Ventilation design for specialist activities shall be as follows:

(i) Occupancy: E

Ventilation provision shall be made either in accordance with Table 4.11.2-1, except for sanitary accommodation where six air changes per hour are required. In spaces where noxious fumes may be generated additional provision for ventilation shall be requiring the use of fume cupboards.

(ii) Occupancy: F

The Authority shall require the owner to satisfy it regarding enhanced ventilation air-conditioning for specific work places:

a. Ventilation means of Industrial Buildings should provide natural ventilation of all industrial buildings having significant internal heat loads due to manufacturing process, proper consideration should be given to the size and distribution of windows and other inlet openings in relation to outlet openings so as to give, with due regard to orientation, prevailing winds, size and configuration of the building and manufacturing processes carried on, maximum possible control of thermal environment; and
b. In the case of industrial buildings wider than 30m, the ventilation through windows may be augmented by roof ventilation.

(iii) Occupancy: I-2

The ventilation needed for various types of accommodation will be different depending on the functional use of the space. These values will also vary throughout the year. The requirements and specifications shall be in accordance with ISO 16814, 16017, ISO 16000-8 and other relevant parts of ISO 16000.

(iv) Occupancies: A and B

Provision shall be made for emergency ventilation to control dispersal of contaminating gas releases (e.g. refrigerant leak). The Authority shall require the owner to satisfy it regarding enhanced air conditioning and ventilation for these areas.

SECTION 3: ELECTRICAL INSTALLATIONS

4.11.3.1. GENERAL REQUIREMENTS

4.11.3.1.1. ELECTRICAL DESIGN CONSIDERATIONS

4.11.3.1.1.1. The general names and graphical symbols used in electrical drawings of any class and occupancy of building should comply with the guidelines given in RS 116.

4.11.3.1.1.2. In the planning and designing the electrical wiring installation, considerations shall be made by a competent electrical engineer to provide an installation that will prove adequate for its intended purpose be reliable, safe and efficient.

4.11.3.1.1.3. Planning and designing the electrical installation of any building shall depend on particular class and category of building and occupancy in accordance with RS 116-1 and luminaries required in accordance with RS IEC 60598-2-1.

4.11.3.1.1.4. As-built electrical diagrams (lighting and power plans, power distribution and riser diagrams, electrical panel schedule) of the installation shall be provided in the Project Profile for every completed installation for safety in operation and maintenance. The diagrams shall be endorsed by the professional design electrical engineer.

4.11.3.1.1.5. All electrical circuits and electrical components of the installation shall be clearly labelled.

4.11.3.2. ELECTRICITY SUPPLY SYSTEM

4.11.3.2.1. The mains supply switch for the electrical installations of any building shall be easily accessible and situated adjacent to the consumer control unit.

4.11.3.2.2. When Standby power supply system was installed, it shall be automatically isolated to prevent parallel operation with the public supply and neutral of the supply shall be changed when it is operating.

4.11.3.2.3. All electrical apparatus shall be suitable for the voltage and frequency of supply. The nominal values of low voltage systems in Rwanda are 220VAC and 415VAC, respectively and the frequency 50Hz.

4.11.3.2.4. Three phase and single-phase circuits LV power cables can be run in the same conduit, provided that the condcuit is appropriately sized.

4.11.3.2.5. CONNECTION OF APPLIANCES TO SUPPLY

4.11.3.2.5.1. Every appliance shall be connected to a supply after revising the nameplate, checking whether the voltage, frequency and type of supply will match the indication on the nameplate.

4.11.3.2.5.2. Every appliance shall be connected by means of a plug and socket outlet of IEC Type G complying with RS IEC 60884-1.

4.11.3.2.5.3. Every appliance shall be controlled by means of a switch in addition to any automatic control device and arranged to disconnect the appliance from a live conductor.

4.11.3.2.5.4. Every heating appliance shall be controlled by a linked switch arranged to break the supply.

4.11.3.3. LIGHTING SYSTEMS AND CIRCUITS

4.11.3.3.1. When electricity is installed for lighting in every building, the system shall include at least one terminal point for lighting in every room having a floor area of $2m^2$ or more and in every bathroom, water closet, entrance vestibule and hall.

4.11.3.3.2. Every light at a stairway terminal landing shall, unless automatic switching devices are installed, be controlled by switches at such landing and at any other terminal landing thereon.

4.11.3.4. ELECTRICAL WIRING AND DEVICES

4.11.3.4.1. Conductors, switches and accessories shall be of a size capable of carrying, without their respective ratings being exceeded, the maximum current that will normally flow through them.

4.11.3.4.1.1. The cables shall fulfill the requirements specified in RS EAS 115 and RS EAS 116.

4.11.3.4.1.2. The conductors used in electric power and lighting circuits shall comply with the requirements given in RS EAS 114.

4.11.3.4.2. Specification, selection in designing and installation of Switchgear and control gear in this Code shall comply with relevant part of IEC 60439.

4.11.3.4.3. Switchboards shall be located in dry and ventilated spaces and each switchboard should have an appropriate Ingress Protection (IP) rating.

4.11.3.4.4. Electrical loose connections shall be avoided by fixing every electrical joint properly with respect to conductance, insulation, mechanical strength and protection and be accessible for inspection and maintenance.

4.11.3.4.5. Installation, design, and installation of every fixed electrical appliance shall comply with the requirements of RS IEC 60364-5-52 for efficiency and safe under operation.

4.11.3.4.6. Every light fitting or other electrical apparatus or appliance in a room containing a fixed bath or shower shall be out of reach of any person, operated by an insulating pull-cord switch, and shall be shrouded in insulating material.

4.11.3.4.7. Where cables are installed behind suspended ceilings or the ceiling space under the roof, they shall be provided with mechanical protection such as being installed within approved conduits. In addition they shall be installed either parallel or perpendicular to the edges of the walls near the ceiling.

4.11.3.4.8. Where cables are installed buried behind walls, they shall be installed horizontally or vertically i.e. parallel to the edges of the room. Subject to the dimensions of the columns and beams, they shall be within 150mm from the top of the walls and 150mm from the edge of the wall.

4.11.3.4.9. Mechanical protection for cables within walls cables installed within walls shall be provided with mechanical protection such as a conduit. Direct installation of cables within walls is not allowed.

4.11.3.4.10. Installation of conductors in buried cable ducts, conduits or cable duct systems intended to be buried in structures shall be completely erected for each circuit before any insulated conductor is drawn in.

4.11.3.4.11. Where a large number of high wattage lamp may be required like in construction sites, stadium, open yards in industrial plants and so on, there shall be no restriction of load on any circuit but conductors used in such circuits shall be of adequate size for the load and proper circuit protection shall be provided.

4.11.3.4.12. A ceiling rose or any other similar attachment shall not embody fuse terminal as an integral part of it, with only one flexible cord attachment and shall not be used on a circuit with the voltage exceeding 250V.

4.11.3.4.13. Ordinary socket-outlet shall be fixed at any convenient place at a height above 20cm from the floor level and shall be away from danger of mechanical injury where the live side of the line of the socket-outlet shall be controlled by a switch.

4.11.3.4.14. Lighting fitting or a group of lighting fittings shall be controlled by a switch. Where control at more than one point is necessary as many two ways or intermediate switches maybe provided as there are control points.

4.11.3.4.15. Fittings Specification and installation shall comply with the requirements of **RS EAS 114.**

4.11.3.4.16. The flexible conduits selection to be used for prevention of mechanical damage of flexible cables and cords of copper or stranded shall comply with the requirements of relevant part of IEC 61386.

4.11.3.4.17. The convention adopted to identify each of the phase in three phase supply shall follow guidelines in table.3.11.3-1.

Table 4.11.3-1: Colour Coding of Wires in Three Phase Supply

N°	Name of Wire	Recommended Colour
1	Live or Line	Red, Yellow, Blue
2	Neutral	Black
3	Earth	Yellow+ green (Together)

N.B: For **single phase** supply the live wire shall always be coded with **red** colour.

4.11.3.5. PROTECTION

4.11.3.5.1. PROTECTIVE DEVICES

4.11.3.5.1.1. RESIDUAL CURRENT DEVICES & CIRCUIT BREAKERS AND FUSES

4.11.3.5.1.1.1. The specification of residual current devices used to provide protection against the specific dangers that may arise in electrical installations, including: protection against indirect contact, supplementary protection against direct contact, protection against fire and thermal effects shall comply with IEC 61008-1

4.11.3.5.1.1.2. If an installation is protected by single residual current devices, it shall be located at the origin of the Installation.

4.11.3.5.1.1.3. Residual current operated circuit-breakers with integral over current protection for household which is a combination of residual current devices and miniature circuit breaker shall be installed for over current protection in electrical installations in compliance with IEC 60755

4.11.3.5.1.1.4. Residual current devices with rated residual operating current not exceeding 10mA shall be installed in the places of public entertainment, where the floor is likely to be wet; and for the protection of electric water heaters.

4.11.3.5.1.1.5. The electric fuse shall be installed on live conductor of electrical installation to cut-out the circuit when electrical danger occurs shall also comply with RS IEC 60269-1

4.11.3.5.1.1.6. Circuit breakers shall be provided on each line of conductors for the mains supply at the point of entry.

4.11.3.5.1.1.7. Switchboards and distribution boards for all circuits and sub-circuits shall be protected against over current and earth faults.

4.11.3.5.1.1.8. The mains circuit and sub-circuits in a building shall be provided with leakage protective devices that, on the occurrence of an earth fault, disconnect the defective circuit from the supply.

4.11.3.5.2. EARTHING

4.11.3.5.2.1. Installation, design and erection of earthing systems on electrical installation and any metalwork not intended to conduct electricity, shall be earthed in accordance with RS IEC 60364-5-54

4.11.3.5.2.2. To ensure effective operation of the circuit protective device, the resistance of the earthing system shall be as low as possible.

4.11.3.5.2.3. Maintenance of earthing system, checking, testing and maintenance of the earthing system of any electric installation shall be done annually.

4.11.3.5.3. PROTECTION AGAINST LIGHTNING

4.11.3.5.3.1. Means of lightning protection for structures and big machines like power transformers, generators shall be installed in compliance with relevant part of IEC 62305.

4.11.3.5.3.2. Surge Protective systems and device shall be installed in prone areas and /or any high rise building, especially for prone areas of lightning and thunderstorms like Rusizi, Nyabihu, Nyamasheke, Ngororero and Rutsiro districts and when structures are supplied by overhead lines in accordance with relevant part of RS IEC 61643.

4.11.3.5.4. PROTECTION AGAINST THERMAL EFFECTS

4.11.3.5.4.1. To protect against fires, and overheating, Electrical equipment that produces heat shall be mounted within materials that can withstand the temperatures produced to minimum. In operation, the temperature attained by the material shall be less than 55°C (if the material is metallic) or 65°c (if the material is non-metallic).

4.11.3.5.4.2. Protection by placing out of reach, measures to protect against direct contact by the use of barriers or enclosures and placing live conductors out of reach are encourage and insulation with a dielectric medium such as Poly Vinyl Chloride or cross linked polyethylene shall indeed be done on bare conductors.

4.11.3.5.5. Isolation on fault, circuit breaker, fuse or residual current devices shall be used for isolating a fault between a live conductor and the metal enclosure of electrical equipment.

4.11.3.6. INSPECTION AND TESTING OF THE INSTALLATION

4.11.3.6.1. Notwithstanding the provisions of Part 14 Section 1, the permittee shall insure the inspection of all electrical installations in relation with the approved plans is done and this shall be approved by a certified professional.

4.11.3.6.2. Periodic inspection and testing shall be carried out by a competent professional after every three years in order to maintain the electrical installations in a good working condition after putting it into service. Where an addition is to be made to the fixed wiring of an existing installation, the competent professional shall fulfill the recommendations specified by this Code.

SECTION 4: AIR-CONDITIONING, HEATING & MECHANICAL VENTILATION

4.11.4.1. GENERAL REQUIREMENTS

4.11.4.1.1. Ventilation and air conditioning installation shall aim at controlling and optimizing following factors in the building:

(i) Air purity and filtration;
(ii) Air movement;
(iii) Dry-bulb temperature;
(iv) Relative humidity; and
(v) Noise and vibration.

4.11.4.1.2. All plans, specifications and data for air conditioning, heating and mechanical ventilation systems of all buildings and serving all occupancies within the scope of the Code shall comply with the relevant national or international standard and relevant parts of ISO 5149 for information technology related.

4.11.4.2. MECHANICAL VENTILATION SYSTEM

4.11.4.2.1. VENTILATION REQUIREMENTS

4.11.4.2.1.1. All rooms and occupied spaces which are not naturally ventilated or air-conditioned shall be mechanically ventilated to achieve removal of heat and possible contaminants such as product of respiration, bacteria, product of combination, etc and maintain acceptable indoor air quality.

4.11.4.2.1.2. It is required to ventilate the car parking areas in a building in order to remove carbon monoxide and other combustion products from the areas.

4.11.4.2.1.3. Except where natural ventilation is available, a mechanical ventilation system incorporating a supply part and an exhaust part, and capable of providing six air changes per hour is required for car parking areas in a building.

4.11.4.2.1.4. The mechanical ventilation system in residential car parking areas may be switched off if the carbon monoxide concentration is below 25 parts per million averaged over a period of one hour.

4.11.4.2.1.5. For the exhaust part of the ventilation system, at least 50% of the exhaust air shall be extracted at low level not exceeding 650mm above the finished floor, as measured from the top of the grille to the finished floor.

4.11.4.2.1.6. The supply air shall be drawn directly from the exterior and its intake shall not be less than 5m from any exhaust discharge openings. Outlets for the supply air shall be adequately distributed over the car park area.

4.11.4.2.1.7. The discharge points of the exhaust ventilation system shall be arranged to discharge directly to the exterior and shall not be less than 5m away from any intake openings, doorways to prevent the re-entry of objectionable flammable vapor into the premises; and shall not also face or discharge in the direction of any adjacent residential building.

4.11.4.2.1.8. Mechanically ventilated kitchens shall be designed for a ventilation rate of not less than 20 air-changes per hour as given in Table 4.11.4-1.

4.11.4.2.1.9. In large kitchens, areas are sub-divided to form wash-ups, preparation, pantry, stores and services, etc. These areas shall be provided with a minimum ventilation rate of ten air changes to create a feeling of comfort.

4.11.4.2.2. MECHANICAL VENTILATION REQUIREMENTS

4.11.4.2.2.1. Adequate number of circulating fans should be installed to serve all interior working areas during summer months in the hot dry and warm humid regions to provide necessary air movement at times when ventilation due to wind action alone does not afford sufficient relief.

4.11.4.2.2.2. MECHANICAL VENTILATION MAINTENANCE

4.11.4.2.2.3. The equipment and systems, electrical, electronic and mechanical controls, and circuit boards associated with mechanical ventilation systems shall be inspected to ensure satisfactory operation within designed conditions.

4.11.4.2.2.4. Check motor running ampere to ensure motor is operating under normal conditions.

4.11.4.2.2.5. It is recommended to check all electrical wiring and connections, circuit protection devices and electrical starter. Rectify or replace if necessary and clean the exhaust hood with suitable cleaning detergent.

4.11.4.2.2.6. Check winding insulation by megger test. Check cable terminals and cables for damage or deterioration. Replace motor bearings, windings, and cable terminals as necessary.

4.11.4.2.2.7. Check the associate circuit protection devices, electrical starter and equipment are in good working condition. Replace contacts and other worn or defective parts as required. Also motor bolts and nuts shall be checked as well.

4.11.4.2.3. DESIGN CONSIDERATIONS

4.11.4.2.3.1. The quality of outdoor air supply for mechanical ventilation for any room or floor space in a building shall be based on its volume and determined according to the rates given in Table 4.11.4-1.

4.11.4.2.3.2. The rates of ventilation given in Table 4.11.4-1 apply to normal types of buildings with normal heat gains from occupants and activates. When abnormal conditions prevail, the ventilation rate may be increased to prevent undue concentration of body odours, bacteria-carrying practices, gas, vapor or dust and to prevent undue accumulation of carbon dioxide and to remove products of combustion.

4.11.4.2.3.3. For any type of room or floor space not specified in Table 4.11.4-1, the ventilation rate shall be assumed considering the value assigned for similar space listed in the Table.

Table 4.11.4-1: Minimum Outdoor Air Supply for Mechanical Ventilation in Non-Air-Conditioned Buildings or Parts of Buildings with No Natural Ventilation

Type of building/Occupancy	**Minimum Outdoor Air Supply Air Change/Hour**
Office	6
Restaurant, canteens	10
Shops(M1, M2, M3)	6
Workshop, factories(F1,F2,F3)	6
Classrooms	8
Car parks	6
Toilets, bathrooms	10
Lobbies, concourse, corridors, staircases	4
Kitchens ,commercial, institutional and industrial	20-60

4.11.4.2.4. CAR PARK VENTILATION

4.11.4.2.4.1. For aboveground car park, no mechanical ventilation is required for any part of the car park where natural ventilation opening of not less than 15% of the floor area served is provided. The naturally ventilated part of the car park shall be within 12m from the ventilation opening except where cross-ventilation is provided.

4.11.4.2.4.2. For aboveground car park without cross ventilation, where additional natural ventilation opening of two less than 15% of the area beyond 12m of the opening is provided, a reduced mechanical ventilation system in the form of fume extract shall be provided.

4.11.4.2.4.3. Where natural ventilation opening equivalent to not less than 2% of the mechanically ventilated areas is provided, the supply part may be omitted.

4.11.4.2.4.4. For basement car park, the mechanical ventilation system shall be designed in such a way that the quality of replacement air shall not exceed that of the exhaust air. This requirement is necessary so that the car park can be maintained under negative pressure at all times to prevent the spread of noxious gases into adjacent occupied areas.

4.11.4.2.4.5. For basement car park exceeding one level, the supply and exhaust parts shall be designed in such a way as to minimize intermixing of air between the different levels.

4.11.4.2.4.6. In a large basement car park, a combination of different modes of mechanical ventilation may be provided as shown in Table 4.11.4-2 below.

4.11.4.2.4.7. Roof ventilation: The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from attics, cathedral ceilings or other enclosed spaces over which a roof assembly is installed.

Table 4.11.4-2: Mode of Ventilation for Basement Car Park

Size of ventilation opening (% of floor area)	**Mode of ventilation to be provided (Mechanical 'MV' or fume extract)**	
	Zone 'A'	Zone 'B'
15% of A + 15% of B	Fume Extract	Fume extract
15% of A + 2% of B	Fume Extract	MV without supply
15% of A	Fume Extract	MV
2% of A + 2% of B	MV without supply	MV without supply
2% of A	MV without supply	MV

Zone 'A' refers to part of car park within 12m of natural ventilation opening

4.11.4.2.5. KITCHEN VENTILATION:

4.11.4.2.5.1. Exhausts from hoods designed to capture smoke and/or grease-laden vapor produced by a cooking process, incorporated with grease-removal devices and fire-suppression equipment shall be directed away from roofs and building surfaces. Exhaust discharge shall not impinge on obstacles such as parapets, overhangs and other equipment and higher parts of buildings.

4.11.4.2.5.2. Washable grease filters with standby units shall be located within the hood as close to the major heat source as practical.

4.11.4.2.5.3. Mechanical exhaust system for the cooking area of a kitchen in a hotel, restaurant, coffee house or the lime shall be independent of those serving other parts of the building.

4.11.4.2.5.4. Kitchen-exhaust hoods shall be installed above appliances of heating capacity greater than 8kW and likely to generate grease vapor (e.g. ranges, fryers, barbecues). Where grease is present, kitchen hoods incorporating grease filters shall be used.

4.11.4.2.5.5. Exhaust air flow shall be suitably distributed over the exhaust hood to capture the cooking vapor emission under still air conditions, which will be considered as room air motion not exceeding 0.15m/s velocity.

4.11.4.2.5.6. Kitchen exhaust hoods shall be manufactured from rigid impervious hard-faced and noncombustible materials, such as mild steel, stainless steel or aluminum.

4.11.4.2.5.7. The seams shall be made liquid-tight seams and the joints made by fusion welding, lapping, and riveting, soldering; or other approved methods.

4.11.4.2.5.8. Hoods shall be fitted with washable grease fitters mounted in frames in positions enabling convenient removal and replacement, and installed so as to prevent significant leakage of air around the filters.

4.11.4.2.5.9. All internal surfaces of hoods shall be vertical or sloped at an angle not greater than $40^0$from vertical. The faces of filters shall be vertical or sloped at an angle not greater than 30^0 from vertical.

4.11.4.2.5.10. It should be possible to assess the pressure drop of the ventilation air as it flows across the grease filter.

4.11.4.2.5.11. Gutters shall be located beneath any protruding surface or edges such as lower edges of filters, except light fittings inside hoods. Internal gutters not greater than 50mm or less than 35mm wide and not less than 10mm deep shall be located around the lower edges of hoods. Plugged drainage holes shall be provided at intervals not greater than 6 m along the gutter.

4.11.4.2.5.12. The lower edges of canopy type exhaust hoods shall be not higher than 1.2m above the cooking surface nor lower than 2m above floor level; and extend not less than 150mm outside the plan perimeter of the appliance over which the hood is installed.

4.11.4.2.5.13. Kitchen exhaust shall be discharged directly to the exterior and away from the habitable areas of the building. It shall not be less than 5m from any air intake openings.

4.11.4.2.5.14. Kitchen-exhaust ducts and shafts shall be sized and installed for the flow rate of air necessary to remove the effluent. Velocities of not less than 9m/s are recommended with the provision of access doors for cleaning at approximately 3m centers.

(i) Ducts forming part of a kitchen exhaust system shall be manufactured from:

(ii) Mild steel of thickness not less than 1.2mm, or

(iii) Stainless steel of thickness not less than 0.9mm, or Other approved materials.

4.11.4.2.5.15. Ducts shall be installed with a fall in the direction of flow of not less than 0.5%.

4.11.4.2.5.16. To enable cleaning of all the ductwork, openings large enough shall be provided at suitable intervals and locations, and/or appropriate cleaning apparatus/systems shall be incorporated. A drain shall be provided at the lowest point of each run of ducting.

4.11.4.2.5.17. The hood and ducts for the exhaust shall have a clearance of 500mm from unprotected combustible materials.

4.11.4.2.6. BATHROOMS AND TOILETS VENTILATION

4.11.4.2.6.1. Air shall be supplied through a ventilation duct directly from the outdoor or from a permanently air-conditioned or naturally ventilated room through louvers in the doors or undercutting the doors or by other openings.

4.11.4.2.6.2. The exhaust system shall dispel the ventilated air directly to outdoors; and the quantity of replacement air shall not exceed that of exhaust air.

4.11.4.2.7. EXIT FACILITIES VENTILATION

4.11.4.2.7.1. Mechanical ventilation systems and internal exist staircase and internal exit passageway shall provide ventilation at the rate of four air changes per hour.

4.11.4.2.7.2. Supply air shall be drawn directly from the exterior with intake point not less than 5m from any exhaust discharge or opening ventilation.

4.11.4.2.7.3. Supply air shall be drawn directly from the exterior with intake point not less than 5m from any exhaust discharge or openings for natural ventilation.

4.11.4.2.8. AIR-CONDITIONING SYSTEM

Air-conditioning shall be installed to provide the control of the temperature and humidity of a zone inside a building that accommodates internal heat gains and exchanges heat and air with the surrounding.

4.11.4.2.9. An air-conditioning unit or system must:

(i) Be capable of being deactivated when the sole-occupancy unit, building or part of the building served is not occupied;

(ii) Where the air-conditioning unit or system has motorized outside air and return dampers, close the dampers when the air-conditioning unit or system is deactivated;

(iii) When serving a sole-occupancy unit, not operate when any external door including a door opening to a balcony, patio, courtyard or the like is open for more than 1 minute; and

(iv) Have any supply and return ductwork sealed and insulated when serving more than one air-conditioning zone or area with different heating and cooling.

4.11.4.2.10. DESIGN REQUIREMENTS

4.11.4.2.10.1. Equipment used in air-conditioning shall have minimum performance in accordance with the level of current technology.

4.11.4.2.10.2. The normal design dry-bulb temperature for comfort air-conditioning can vary from 24ºC to 26ºC with the lower temperature applicable to zones with solar load and the higher value in all other zones.

4.11.4.2.10.3. When a space has significant sensible equipment load, care should be taken for situations when the equipment is operating at part-load.

4.11.4.2.10.4. The specification of indoor conditions shall take into considerations the anticipated mean radiant temperature and air movement.

4.11.4.2.10.5. The design outdoor air conditions shall be taken for dry-bulb and wet-bulb with a daily range calculated between maximum and minimum temperatures. The dry-bulb temperature value shall exceed more than 2.5% of the total hours and the wet bulb value is the average of the coincident wet-bulb temperature occurring at the design dry-bulb temperature. The load contribution from the outdoor air introduced into a building for ventilation shall be calculated.

4.11.4.2.11 INDOOR THERMAL ENVIRONMENT

When the air-conditioning system is in operation, the operative temperature should be maintained within 24ºC and 26ºC and the air movement should not exceed 0.3m/s, measured at the occupants' level 1500mm from the floor.

4.11.4.2.12 OUTDOOR FRESH AIR SUPPLY

4.11.4.2.12.1. The rates of ventilation given in Table 4.11.4-3 apply to normal types of buildings with normal heat gains from occupants and activities and no-smoking in air-conditioned spaces.

4.11.4.2.12.2. When abnormal conditions prevail, the ventilation rate may be increased to prevent undue concentration of body odours, bacteria-carrying particles, gas, vapor or dust and to prevent undue accumulation of carbon dioxide and to remove products of combustion.

4.11.4.2.12.3. For any type of room or floor space not specified in this section, the ventilation rate shall be determined by the qualified person subject to the approval of the relevant authority.

4.11.4.2.12.4. In air-conditioned office premises, classrooms and theatres, the supply of outdoor air can be varied according to occupancy.

Table 4.11.4-3: Outdoor Air Supply Requirement for Comfort Air-Conditioning

Type of Building/ Occupancy	**Minimum Outdoor Air Supply**		
	L/s per m^2 floor area	m^3/h per m^2 floor area	L/s per person
Restaurant	3.4	12.2	5.1
Dance halls	7.0	25.0	10.5
Offices	0.6	2.0	5.5
Shops, supermarkets and department stores	1.1	3.8	5.5
Theatres and cinemas seating area	2.0	7.3	3.0
Lobbies and corridors	0.3	1.1	3.3
Concourses	1.1	4.0	3.3

Hotel guest rooms	15 L/s per room	54 m^3/h per room	5.5
Primary school children and above	2.8	10.0	4.2
Childcare centers	2.8	10.0	8.4

Note:

(i) Dance halls refer to night clubs. The outdoor air supply in discotheques requires 50 % more than that in dance halls; and

(ii) The use of higher outdoor air supply in hotel guest rooms stipulated in Table 4.11.4-3 should take precedence.

4.11.4.2.12.5. Unless there is monitoring and control of the concentration of carbon dioxide indoors, the design outdoor air quantity should be maintained during the air-conditioning operation.

4.11.4.2.12.6. In existing building, where the air-conditioning systems have been designed for a lower ventilation rate, the indoor air quality can be improved by using suitable filters for the particulates or gases.

4.11.4.2.13 INDOOR SUPPLY AIR

4.11.4.2.13.1 The cool supply air should be directed away from the fenestration glazing or the glazing adjacent to a non-air conditioned area to prevent moisture condensing on the outside surface.

4.11.4.2.13.2 The cool air leaving the supply diffuser should be designed at a temperature less than 2^{O}C above the room dew point to prevent moisture condensing on the diffuser surface.

4.11.4.2.14 PURGING OF INDOOR AIR

4.11.4.2.14.1 For air-conditioned buildings, an air purging system should be provided at each floor so that contaminated air can be exhausted when necessary to improve the indoor air quality.

4.11.4.2.14.2 The air purging system should be able to introduce outdoor air into the space and then discharge the indoor air to outside the building at a minimum rate of 2 air-changes per hour.

4.11.4.2.14.3 The capacity of the exhaust fans shall be higher than the flow rate of the outdoor air introduced in to the space.

4.11.4.2.14.4 For building with fixed windows, the outdoor air for purging can be supplied by the fan for air- conditioning or others.

4.11.4.2.14.5 The exhaust discharge shall be at least 5m from the outdoor air intake of another system.

4.11.4.2.15 AIR FILTRATION

4.11.4.2.15.1 Outdoor air for ventilation and indoor air that is to be re-circulated should be filtered for particulate.

4.11.4.2.15.2 It should be possible to assess at any time the condition of the air filter and the pressure drop across it.

4.11.4.2.16 CONTROL REQUIREMENTS

4.11.4.2.16.1 The design of the control system shall allow operation to utilize energy efficiently while maintaining the desired indoor conditions.

4.11.4.2.16.2 When an air-conditioning system has to serve areas with different cooling requirements, sufficient number of zones shall be provided.

4.11.4.2.16.3 At least one thermostat of suitable operating range shall be provided to each separate air-handling system and zone for the regulation of space temperature.

4.11.4.2.16.4 A readily accessible manual or automatic means shall be provided to partially restrict or shut of the cooling to each zone.

4.11.4.2.16.5 Air-conditioning systems shall be equipped with at least one of the following to enable them to shutdown automatically:

(i) Controls that can start and stop the system under different time schedules for seven different days per week with manual override, or equivalent function that allows temporary operation of the system for up to two hours; and

(ii) An occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.

4.11.4.2.17 Zones that are intended to operate or be occupied non-simultaneously should be grouped into isolation areas. Central systems and plants serving these zones are provided with controls and devices that enable a stable system and equipment operation for any length of time while serving only the smallest isolation area.

4.11.4.2.18 A minimum of one of the following control technologies shall be required in hotel guest rooms with over 50 rooms such that all the power to the lights and switched outlets in hotel guest room would be turned off when the occupant is not in the room and the space temperature would automatically set up by no less than $3^{O}C$:

(i) Controls that are activated by the room occupant via the primary room access method-key, card, deadbolt; and

(ii) Occupancy sensor controls that are activated by the occupant's presence in the room.

4.11.4.2.19 DESIGN AND INSTALLATIONS REQUIREMENTS OF HEATING, VENTILATION AND AIR COOLING SYSTEM

4.11.4.2.19.1 The main objective of the Heating Ventilation and Air Conditioning design will be to provide correctly sized heating, ventilation and air conditioning systems for the building and

(i) Be properly sized to provide correct air flow and meet room by room calculated heating and cooling loads;

(ii) Be installed so that the static air pressure drop across the handler is within manufacturer and design specifications;

(iii) Have sealed supply ductwork that will provide proper air flow;

(iv) Be installed within return system sized to provide correct return air flow;

(v) Have sealed return ductwork that will provide proper air flow to the fan and avoid air entering the Heating Ventilation and Air Conditioning system from polluted zones;

(vi) Have balanced air flows between supply and return systems to maintain neutral pressure in the home;

(vii) Minimize duct air temperature gain or loss between the air handler and room registers and between return registers and the air handler;

(viii) Be properly charged with refrigerant; and

(ix) Have proper burner operation and proper draft.

4.11.4.3 VENTILATION AND AIR CONDITIONING EQUIPMENT

4.11.4.3.1. VENTILATION EQUIPMENT CONSIDERATIONS

4.11.4.3.1.1. FANS INSTALLATIONS REQUIREMENTS

4.11.4.3.1.1.1. Fans must be properly installed to achieve smooth control and correct performance. In general, manufacturer recommendations should be followed.

4.11.4.3.1.1.2. Fans should be located so the discharge of one does not enter the intake of another fan. Intake area should be at least 20 percent greater than the fan wheel discharge area.

4.11.4.3.1.1.3. Fans located opposite from each other should be separated by at least six fan diameters.

4.11.4.3.1.1.4. Elbows or other abrupt duct transformations on the discharge side of the fan should not be closer than one diameter from the fan wheel.

4.11.4.3.1.1.5. Direction of fan discharge and rotation should be selected to match duct or mounting requirements.

4.11.4.3.1.1.6. Fans shall be supported and restrained by non-combustible devices in accordance with the structural design requirements.

4.11.4.3.1.1.7. Motors and drives shall be easily accessible for operation, maintenance and repairs, and all rotating parts shall be guarded adequately.

4.11.4.3.1.1.8. Sufficient clearance and access shall be provided for inspection, cleaning and maintenance.

4.11.4.3.1.1.9. Air passage duct connection with the fan unit shall be through flexible duct.

4.11.4.3.1.1.10. The flexible duct materials shall be made of material classified as not easily ignitable and shall not exceed 250mm in length.

4.11.4.3.2. AIR CONDITIONING EQUIPMENT

4.11.4.3.2.1. AIR HANDLING UNIT

4.11.4.3.2.1.1. The condensate from the cooling coil shall be provided with trap on leaving the air handler and there should be an air break between the condensate drain pipe and sanitary drain system to avoid back flow.

4.11.4.3.2.1.2. The air handler unit shall have sufficient access for cleaning and maintenance and the inner surface shall be easy to clean and shall be abrasion resistant.

4.11.4.3.2.1.3. The air handling unit shall have electrical power isolating switch on the unit or adjacent to the unit within 3 meters distance for maintenance and quick shut down purpose.

4.11.4.3.2.1.4. Air handling units installed in open space the electrical isolating switch shall be all weather resistant.

4.11.4.3.2.2. HEAT RECOVERY UNITS

4.11.4.3.2.2.1. Heat recovery devices shall be used in ventilation systems to provide heat recovery from exhaust to supply air in winter and can also recover cooling in peak summer conditions.

4.11.4.3.2.2.2. Selection of equipment should be suitable for process exhaust temperatures. Where the recovered heat is fed to a ventilation system, modulation control is normally required to prevent overheating in warm weather.

4.11.4.3.2.3. AIR HEATING EQUIPMENT

4.11.4.3.2.3.1. Air heating media can be electricity, hot water, steam or refrigerant gas.

4.11.4.3.2.3.2. Air heating coils shall be manufactured from materials which shall resist corrosion and can provide good conductivity.

4.11.4.3.2.3.3. The operation of heaters shall be through automatic temperature control system, in order to meet the set room temperature value.

4.11.4.3.2.4. INSTALLATION LOCATION

When selecting a site or room for the location of any piece of equipment, various factors shall be done in accordance to ISO 5149-3, and shall be considered including the following:

(i) Equipment type (Indoor, outdoor);
(ii) Hoisting for initial installation and future maintenance, or replacement works;
(iii) Transmission of noise to adjacent areas;
(iv) Discharge of heat to and from adjacent buildings;
(v) Ventilation requirements;
(vi) Space for service access, operational requirements and future expansion;
(vii) Support structure for equipment, ducts;
(viii) Utilities connections;
(ix) Fire hazard, protection and construction of fire rating wall; and
(x) Safety of working, and maintaining personnel.

4.11.4.3.2.5. EQUIPMENT CLEARANCE AND SPACE REQUIREMENT

4.11.4.3.2.5.1. Ventilation equipment shall be installed with sufficient working space for inspection and routine maintenance (e.g. filter replacement and fan belt adjustment and replacement).

4.11.4.3.2.5.2. All gauges, meters, should be installed in such a way that they are easily readable and replaceable.

4.11.4.3.2.5.3. All sensors shall be installed in such a way that they are easily accessible for regular calibration.

4.11.4.3.2.5.4. Access panels shall be provided for boxes, fan coil units, electric heaters, valves, fans and any accessories concealed in a closed space wall or ceiling.

4.11.4.3.2.5.5. Platform supported equipments shall have enough space for maintenance and shall be provided with cat walk. Such concealed units shall have good sound insulation and vibration isolation devices.

4.11.4.3.2.5.6. Installation techniques to consider vibration control in Heating, Ventilation and Air Conditioning systems shall be controlled by considering the following installation techniques.

4.11.4.3.2.5.7. Ensure that vibration isolation is properly installed with no bridging material across the flexible mountings.

4.11.4.3.2.5.8. Ensure that vibration isolators are loaded to give equal deflections and installed to maintain vertical alignment of their springs and other components.

4.11.4.3.2.5.9. Isolators shall be aligned with the equipment as misaligned isolators are a source of different problems.

4.11.4.3.2.6. VENTILATION EQUIPMENT ACCESS

4.11.4.3.2.6.1. Access doors, panels, or other means shall be provided and sized to allow convenient and unobstructed access sufficient to inspect, maintain, and calibrate all ventilation equipment

4.11.4.3.2.7. Equipment connection to ducting shall be through the use of flexible duct.

4.11.4.3.2.8. AIR HEATING EQUIPMENT

4.11.4.3.2.8.1. When installing Maintenance access shall be provided to access the heating equipment for servicing and maintenance.

4.11.4.3.2.8.2. Electrical heaters shall be interlocked with the fan motors to avoid the switching of the heaters without the air blowing, and all electric heaters shall have controls such as thermostat and over heat protection.

4.11.4.3.2.9. DUCTWORK AND ACCESSORIES

4.11.4.3.2.9.1. DESIGN CONSIDERATIONS

(i) DUCTWORK AND AIR DISTRIBUTION

a. Designers should specify the requirements, as appropriate for the velocity and pressure, and materials to be employed. Ductwork is generally manufactured from galvanized steel sheet.

b. Ductwork may also be manufactured from aluminum sheet for applications like operation theatres and intensive care units where stringent cleanliness standards are a functional requirement.

c. In designing the ductwork for an air distribution system, consideration should be given to the air velocities in ducts, choice of materials and construction of the ducts, etc.

d. For the best economic solution, the duct system shall be designed at the smallest aspect ratio in co-ordination with the space available for duct installation.

e. Maximum velocity for different applications shall be in accordance with Table 4.11.4-4 and for the pressure class shown in Table 4.11.4-5.

Table 4.11.4.-4: Maximum Velocities for Low Pressure Ducting System

Application	**Velocity (m/s)**	
	Main Duct	**Branch Duct**
Theatres, auditorium, studios	4.0	3.0
Hotel bedrooms, conference halls, operating theaters	5.0	3.0
Private offices, libraries, cinemas, hospital wards	8.0	4.0
General offices, restaurants, department stores	7.5	5.0
Cafeteria, supermarkets, machine rooms	9.0	8.0
Factories, workshops	12.0	7.5

Table 4.11.4.-5: Duct System Classification

Duct Pressure Class	Static Pressure Limit		Mean Air Velocity (m/s)
	Positive (Pa)	Negative (Pa)	
Low	500	500	10
Medium	1000	750	20
High	2500	750	40

f. Ventilation ducts should not pass through smoke-stop, fire fighting lobbies or fire exits. Where unavoidable, fire or smoke dampers shall be installed at the location where duct crosses fire wall.

g. Air ducts shall be made substantially air tight throughout, and shall have no openings other than those required for proper operation and maintenance of the system. Access openings shall be provided where debris, paper or other combustible materials may accumulate in plenums and ducts. Removable grilles requiring only the loosening of catches or screws for removal may be considered as access openings.

4.11.4.3.3. OUTDOOR AIR INTAKES

4.11.4.3.3.1. Outdoor air intakes shall be covered with an insect screen and protected from rain entrainment. Screening shall be of corrosion resistant material not larger than 10mm mesh.

4.11.4.3.3.2. Outdoor air intakes should be protected from water droplets such that no water droplet can enter the ventilation air stream.

4.11.4.3.3.3. Outdoor air intakes as bird screens/exhaust outlets shall include screening devices designed to prevent by a 15mm diameter probe.

4.11.4.3.4. LOCATIONS OF INTAKES AND RETURN AIR OPENINGS

4.11.4.3.4.1. The location of outdoor air intakes for air-handling systems shall take due account of any other intake openings for ventilation or exhaust. The intakes of outdoor air to all air-conditioning and mechanical ventilation systems, including those of the ventilation and pressurization of stair shafts, shall be located at external walls or at roof level, arranged so as to pick up outdoor air free of contamination or odours.

4.11.4.3.4.2. Openings for the intakes of outdoor air to all air handling systems, mechanical ventilation systems, pressurization systems of exit staircases and internal corridors, and smoke control systems shall be no less than 5m from any exhaust discharge openings.

4.11.4.3.4.3. Outdoor air intakes shall not be within 5m of exhaust discharges from any buildings, kitchens, toilets, car parks, cooling towers, laundries, rubbish dumps or plant rooms. The distance from an air intake to a cooling tower is measured from the base of the cooling tower.

4.11.4.3.4.4. All return air openings and outdoor air intakes shall be so located and arranged that sources of ignition such as lighted matches and cigarette butts accidentally entering the openings and intakes shall not be deposited onto the filter media.

4.11.4.3.4.5. For air-conditioned spaces, the bottom of the outdoor air intakes shall not be less than 2.1m above the outside floor level, when the air intakes are adjacent to car parks or busy area.

4.11.4.3.4.6. Exhaust ducts from toilets and domestic kitchens shall not be connected to duct systems serving other areas except at the inlet of the exhaust fan. Where such connection is made, devices shall be installed to prevent the circulation of exhaust air though the dwelling units when the fan is not operating. Exhaust ducts for industrial or commercial kitchens shall be of a separate system.

4.11.4.3.4.7. Exhaust ducts shall discharge directly to the outdoors. When exhausts are adjacent to pedestrians' area, the location of the exhaust air discharge shall not be less than 2.1m above the outside floor level.

4.11.4.3.4.8. Ducts shall not be located where they will be subject to damage or rupture. Where so located they shall be suitably protected.

4.11.4.3.4.9. Return air ducts should be routed away from toilets or places where odours are expected and may re-circulate into the supply air stream.

4.11.4.4. HEATING

4.11.4.4.1. Any system of heating in a building shall be designed, constructed and installed to operate safely, and any flue, flue pipe or chimney used in the system shall be designed to remove any smoke, fumes or noxious gases without causing harm to the building or creating a hazard.

4.11.4.4.2. Any flue pipe designed or installed in connection with the heating of a building shall be such that it shall not cause a fire hazard to any adjacent material and shall not be connected to any shaft or duct that forms part of a ventilation system.

4.11.4.4.3. A chimney, which is within or is attached to any building, shall be designed of constructed of non-combustible material and it shall be installed in such a manner that it will not cause a fire hazard to any adjacent material.

4.11.4.4.4. Where the walls of a chimney in any building are comprised of masonry, the walls shall be solid masonry units not less than 100mm in thickness, internally lined with approved non-combustible material capable of withstanding any action of the flue gases, and shall resist, without cracking or softening, the temperature to which it shall be subjected.

4.11.4.4.5. The height of a chimney outlet shall not be less than 1.0m above the highest point of contact with any roof of a building, the highest point of any window or of any roof light capable of being opened, any ventilation inlet situated in a roof or in an external wall except that, in addition, the horizontal distance from the nearest window, roof light, or inlet to the chimney outlet shall not be less than 2m.

4.11.4.4.6. Every fire place used for the burning of solid fuel shall have a hearth made of non-combustible material of approved thickness, and the hearth shall extend not less than 500mm in front of the grating or fire basket and not less than 300mm on either side of the grating or fire basket.

4.11.4.4.7. The air velocity through the heaters should be sufficient to permit the absorption of the rated output of the finned tube heaters within its range of safe temperatures and the exact velocity determined in conjunction with the manufacturers of the heater.

4.11.4.5. ROOF MOUNTED SOLAR WATER HEATER REQUIREMENTS

4.11.4.5.1. Solar collectors should have at least four fixing points connecting the solar collector to the building. The outermost fixings should be within 200mm of the outside edge of the solar collector.

4.11.4.5.2. The solar collector should ideally be positioned centrally on a roof plane. The solar collector should not be located adjacent to eaves, ridge lines or roof edges.

4.11.4.5.3. The erection of any solar water heater not exceeding $6m^2$ in area on any roof or $12m^2$ when erected other than on any roof.

4.11.4.5.4. The roof framing should not be reduced in strength except as a result of drilling for bolts or screws to fix the solar collector to the roof.

4.11.4.5.5. If the hot water storage tank is installed in the attic space, it should have a maximum size of either: 200 litres for small residential houses or 450 litres for complex buildings.

4.11.4.5.6. The building should not be in a wind zone where the ultimate limit state design wind speed exceeds 50m/s.

4.11.4.5.7. If the solar collector is installed at a different pitch to the pitch of the roof cladding then the solar collector should:

(i) Face in the same compass direction as the section of the roof that it is fixed to, and

(ii) Be installed at a pitch no steeper than 45°.

SECTION 5: ACOUSTICS, SOUND INSULATION & NOISE CONTROL

4.11.5.1. ACOUSTICAL PLANNING AND DESIGN CONSIDERATIONS

4.11.5.1.1. Acoustical planning, including all parts and details, shall be performed during design phase of any project and shall comply withSO 11855, ISO 354, ISO 1680 and ISO 20189.

4.11.5.1.2. In residential areas zones planning shall be elaborated in order to reduce noise, roads within a residential area shall be kept to a minimum both in width and length, and shall be designed to discourage car speeding.

4.11.5.1.3. Good design practices shall minimize the amount of noise entering a building from adjoining building and shall be compatible with requirements of other environmental factors including natural light, ventilation and heat for working in an overall energy.

4.11.5.1.4. Bedrooms shall not be designed alongside access balconies, water-closets shall not be designed over living rooms and bedrooms, whether within the same dwelling or over other building.

4.11.5.1.5. During design noisy areas such as living rooms, kitchens, laundries and bathrooms shall be grouped together possibly sharing common walls and quiet areas such as studies and bedrooms shall be grouped away from noisy areas and shall be grouped together.

4.11.5.2. SOUND INSULATION FOR BUILDING ELEMENTS

4.11.5.2.1. The sound insulation performance of building elements shall be improved by increasing the surface mass of the material; the use of additional skins of material, the use of limp materials or materials with low stiffness; and the addition of damping especially to thin stiff elements in a partition system.

4.11.5.2.2. The required sound insulation of a floor, ceiling or a wall shall not be compromised by the incorporation or penetration of a pipe or other service element or a door assembly.

4.11.5.2.3. Any discontinuity in isolated walls shall not be bridged or short circuited by nails screws, noggins or packers. Flexible connectors shall be installed for pipes and ducts to limit structure-borne noise transfer.

4.11.5.2.4. Mechanical and hydraulic services such as Heating, Ventilation and Air Conditioning system equipment, air ducts shall be located away from sensitive areas within the unit or outside the building to minimize the background noise they create. A flexible coupling must be used at the point of connection between the service pipes in building and any circulating or other pump.

4.11.5.2.5. A suitable soft connecting material such as rubber; neoprene or isolation springs shall be used between the elements within a building element; to reduce the amount of structure-borne noise.

4.11.5.3. NOISE CONTROL REQUIREMENTS

4.11.5.3.1. CONTROL OF INDOOR NOISE

4.11.5.3.1.1 The details of site and internal planning and insulation requirements shall be covered under individual occupancies as applicable to the respective character and sources of noise in different buildings.

4.11.5.3.1.2 The acceptable noise levels and the recommended insulation values for the various areas shall be achieved by providing sound insulation treatments by constructional measures.

4.11.5.3.1.3 Maximum Permissible Intrusive noise levels: The ambient noise levels to be met for both domestic and non-domestic buildings shall comply with RS 236.

4.11.5.4.1. CONTROL OF OUTDOOR NOISE

4.11.5.3.1.4 The planning shall be undertaken in such a manner that the noise shall be kept at a distance. Quiet zones and residential zones shall be placed with adequate setback from noise sources, like airports, highways, railway lines and factories. Noise barriers shall be provided by placing buildings and occupancies less susceptible to noise between the source and the more susceptible ones.

4.11.5.3.1.5 A noise survey shall be conducted and a Noise Map shall be prepared to identify source, type, intensity, frequency and other parameters of noise in and around the site of any specific project. Noise levels should be measured for pick and off pick hours of both working and holidays, and also for 'Day Time' and Night Time.

4.11.5.5. NOISE LEVEL REQUIREMENT FOR NEW HOUSING AND REFURBISHMENTS

4.11.5.5.1. Noise should be taken into account when determining building applications and, where appropriate, conditions requiring adequate noise protection should be imposed where external free field noise levels are emitted.

4.11.5.6.1. OCCUPANCY R

4.11.5.6.1.1. Quiet and noisy quarters shall be grouped and separated horizontally and vertically from each other by rooms. Adequate sound insulation shall be provided in separating wall to ensure sound permissible in residential house.

4.11.5.6.1.2. Design of penetrations in acoustically-rated building elements, such as ceilings, floors, walls, bulkheads and risers, shall be well designed and sealed so as not to reduce the sound rating of the building element and to minimize flanking.

4.11.5.6.2. OCCUPANCY E

4.11.5.6.2.1. The school building shall be located as far away as possible from the sources of outdoor noise such as busy roads, railways, neighbouring market places or adjacent shopping areas as well as local industrial and small scale manufacturing concerns.

4.11.5.6.2.2. Halls and Circulation Areas: The lobby, lounge areas or other circulation spaces and linking corridors shall be separated from teaching areas, lecture galleries or laboratories. No direct window openings shall be placed along the walls of the corridors or circulation areas.

4.11.5.6.3. OCCUPANCY I-2

4.11.5.6.3.1. Site shall be selected to keep adequate distance from traffic noise from highways, main roads, railroads, airports and noise originating from parking areas.

4.11.5.6.3.2. Rooms to be used for board meetings, conference, counselling and instructional purposes shall be grouped near public zones of the building to avoid noise and rooms housing equipment, operational facilities and patient service facilities shall be designed for adequate sound insulation.

4.11.5.6.4. OCCUPANCY A

4.11.5.6.4.1. Buildings of Occupancy A shall be designed for both transmission of noise through the walls and openings and also for internal acoustics.

4.11.5.6.4.2. The auditorium shall be effectively separated from all exterior and interior noise and vibration sources as far as practicable. The hall shall be free of such acoustical defects as echoes, long delayed reflections, flutter echoes, sound concentrations, distortions, sound shadow and room resonance etc.

4.11.5.6.5. OCCUPANCY M

4.11.5.6.5.1. The entire portion of the ceiling shall be treated with sound absorption materials and machines like typewriters, calculators, printers etc. shall be fitted or installed with resilient pads to prevent the floors or tables (on which they stand) from acting as large radiating panels.

4.11.5.6.6. OCCUPANCY F

4.11.5.6.6.1. Noisy areas shall be separated from spaces requiring silence. Soft and resilient materials shall be applied on hard surfaces where impact noise can originate.

4.11.5.6.6.2. Flexible mountings, anti-vibration pads, floating floors etc. shall be used to prevent the transmission of vibration and shock from various machines into the building or structure.

SECTION 6: STAIRWAYS, RAMPS & GUARDING

4.11.6.1. STAIRWAYS

4.11.6.1.1. GENERAL REQUIREMENTS

4.11.6.1.1.1. Any stairway or ramp , including walls, screens, balustrades, wells, or shafts of the stairway, ramp or lift shall be designed and constructed so as to sustain dead and imposed loads or any other forces to which it may be subjected.

4.11.6.1.1.2. The staircases shall be provided in every building exceeding one storey in height in order to give access to the upper floors even if there is another access to those floors.

4.11.6.1.1.3. All multistoreyed buildings shall have staircase for regular use which facilitate the accessibility of all floors and shall be provided in addition an emergency staircases as specified in part 10, section 1of this code.

4.11.6.1.1.4. In every multistory building, the main staircase:

(i) shall have a minimum clear height of 2m;
(ii) Shall have a minimum clear width complying with the Table 4.11.6-1;
(iii) shall be provided with handrails on one or both sides;
(iv) Shall be set so as to provide access to a street or any other open space; and
(v) Shall be provided with a door if it continues up to the roof of building as means of escape in the case of fire.

4.11.6.1.1.5. The provisions of escape and rescue in the case of emergency shall be available in every building by considering the intended use of building.

4.11.6.1.1.6. Stairways shall be designed and constructed according to the limiting dimensions shown in Table 4.11.6-1.

4.11.6.1.1.7. A series of stairs between landings shall not exceed 16 risers, and a change in direction shall be required after two successive series of stairs between landings without a turn.

4.11.6.1.2. DIMENSIONAL REQUIREMENTS IN STAIRWAYS

4.11.6.1.2.1. Any stairway shall have dimensions proper to its use.

4.11.6.1.2.2. The headroom measured vertically from the pitch line shall comply with the Table 4.11.6-1.

4.11.6.1.2.3. Width:

(i) Any stairway shall have a width complying with the dimensions given in the Table 4.11.6-1; and

(ii) For spiral stairway, the width shall be not less than 800mm and shall not be used as emergency route.

4.11.6.1.2.4. Treads and risers:

(i) For the purpose of this Code, risers shall be constant throughout a flight and shall be measured vertically from the top of the next tread. The risers' dimensions shall be found in the table 4.11.6-1. This shall not forbid the use of tapered treads in the same flight with treads that are not tapered; and

(ii) All treads shall be leveled and shall extend for the whole width of the stairway.

Table 4.11.6-1: Limiting Dimensions of Stairs

Stair Use	Maximum Riser(mm)	Minimum Width(mm)	Minimum Tread(mm)	Headroom (m)
Private access to single room	200	600	225	2.1
Dwelling Unit	180	800	250	2.1
Domestic Building Common Access	170	1000	250	2.1

Public and all other buildings	170	1200	280	2.1

4.11.6.1.3. LANDING

4.11.6.1.3.1. A landing of length not less than the width of a stairway or 750 mm, whichever is greater, shall be provided at each end of a flight of stairs.

4.11.6.1.3.2. Internal landings shall be unobstructed and level, while external landings shall also be unobstructed, but may be ramped away from the lowest step at a slope not exceeding 1 to 12.

4.11.6.1.3.3. The vertical rise for flight of stairs shall be 3m maximum between landings.

4.11.6.1.3.4. There shall be prohibited to open a door against the stairway except that such door is opened onto the landing and its width shall be less than the one of landing.

4.11.6.1.4. STAIRS WITH TAPERED TREADS

The going for the stairs with tapered treads shall be found as follows:

(i) If the flight is narrower than 1m wide, measure in the middle; and

(ii) If the width of flight is 1m or wider measure 270mm from each side.

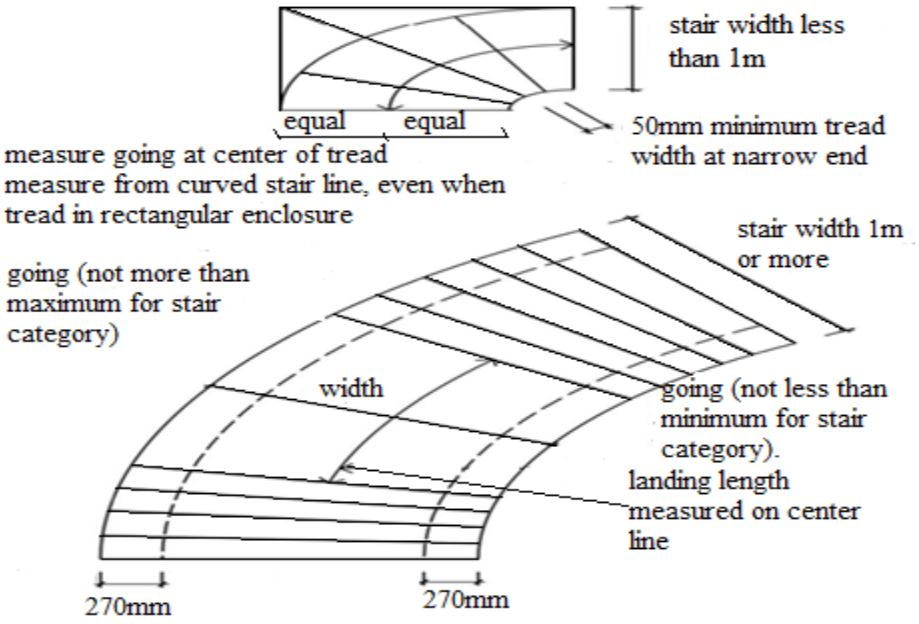

Figure 4.11.6-1: Tapered Treads Measuring

4.11.6.1.5. PROVISIONS FOR ESCAPE AND RESCUE MEANS

4.11.6.1.5.1. Secondary and fire escape stairways shall be of the dimensions not less than those specified for domestic buildings in the Table 4.11.6-1 and in special circumstances, Authority may allow the use of an approved type of escape ladder or any other equipment in place of escape stairways.

4.11.6.1.5.2. An adequate number of staircases designed and constructed so as to allow firemen and access to all floors of building in fire case shall be provided to a building exceeding one storey building in height.

4.11.6.1.5.3. The access staircase in every building shall be designed and built in the manner that the sufficient number of firemen may get to the fire safely protected from fire and smoke.

4.11.6.1.5.4. The regulation of 4.11.6.1.5.3 shall not be applied to the domestic buildings and single household unit not exceeding 3 main storeys in height.

4.11.6.1.5.5. Tapered treads shall not be permitted in a stairway that is used as an emergency route.

4.11.6.1.6. FIRE SAFETY REQUIREMENT

Any stairway provided in a building shall fulfill all the requirements provided in this code in the chapter 3 for fire safety.

4.11.6.2. RAMPS

4.11.6.2.1. GENERAL REQUIREMENTS

4.11.6.2.1.1. In any building not being classified as R-5, wherever such building is situated, any ramp anticipated to be used by motor vehicles shall have a slope less than 1:25 within a distance of 5m from the street crossed by that ramp.

4.11.6.2.1.2. All ramps or driveways shall be designed to be safe and fit for the purpose for which it is intended. The maximum grade for ramps for disabled persons shall be 1:12.

4.11.6.2.1.3. Any ramp intended to be used by vehicles and pedestrians shall possess a walkway of minimum 1.2m wide which can be provided with a curb not less than 150mm high.

4.11.6.2.1.4. The ramp shall fulfill all the fire safety installations requirements provided in this code and shall provide access for disabled persons as referred in Part 10, Section 3 of this code.

4.11.6.2.2. PEDESTRIAN RAMPS

4.11.6.2.2.1. The required clear headroom for ramps and landings shall be not less than 2m and no obstruction shall be allowed in a medium where placed a ramp, it shall be clear all time

4.11.6.2.2.2. After every travel distance of 9m, a landing should be provided for ramp.

4.11.6.2.3. PARKING

4.11.6.2.3.1. Parking for automobiles, vans, buses and trucks shall be provided within the boundary of the site in accordance with the Table 4.11.6-2.

Table 4.11.6-2: Parking Requirements

Occupancy	No. of Parking lots required per 1000m^2 of built-up area		
	Automobiles	Vans	Truck/Vans

A	5	-	1
B	10	-	1
E	2	-	-
F	1	2	1
I	2	2	-
M	2	-	1
R	10*	-	1**
S	1	-	1

* 1 per 100m^2 of detached dwelling house ** for hotels only

4.11.6.3. GUARDING

4.11.6.3.1. GENERAL REQUIREMENTS

Protection at the edges of a balcony, bridge, flat roof, retaining wall or similar member of any building or structure shall be provided with a balustrade, parapet or other approved protection to prevent any person from falling from the balcony, bridge, flat roof, retaining wall or similar member of the building or structure.

4.11.6.3.2. STAIRWAYS GUARDING

4.11.6.3.2.1. HANDRAILS FOR STAIRS

4.11.6.3.2.1.1. Any series of stairs rising more than 600mm shall have a continuous handrail fixed at a height of not less than 900mm above the pitch line of the stairs or top of landing; where the width of the stairway exceeds 1.0m, two handrails shall be provided, one on each side; and a stairway which is wider than 2.0m shall be divided by handrails into sections not less than 1.0m in width nor wider than 1.5m.

4.11.6.3.2.1.2. A handrail shall not encroach more than 75mm into the width of the stairway and shall be supported by a vertical baluster spaced at a distance not exceeding 125mm centre to centre.

4.11.6.3.2.1.3. The fixed handrails shall be provided on both sides of fixed ladder.

4.11.6.3.2.2. GUARDING FOR STAIRS

4.11.6.3.2.2.1. The flights and landings shall be guarded when there is a drop great than 600mm in dwelling buildings and when there are two or more risers in the other buildings.

4.11.6.3.2.2.2. A guarding of a private stair shall resist a horizontal force equal to 0.36KN for each meter of length at a height given in Figure 4.11.6-1.

4.11.6.3.2.2.3. The guarding to a flight should prevent children to be detained by the guarding except stairs not to be used by children under 5 years old.

4.11.6.3.3. RAMPS GUARDING & HANDRAILS

The guarding for ramps should be provided in the similar way as stairs.

4.11.6.3.4. PEDESTRIAN GUARDING

4.11.6.3.4.1. Guarding shall be available where it is practically needed for safety to guard the ends of any part of balcony, roof, floor gallery or elsewhere that people can access(except for the purpose of maintenance or repair) and any light well, basement area or similar drawn area next to a building.

4.11.6.3.4.2. In the vehicles parking, but not on any ramp used only for vehicle access, guarding should be provided.

4.11.6.3.4.3. Any structure serving as guarding such as wall, parapet, balustrade or any other similar obstruction shall have the height shown in the Table 4.11.6-3 and shall be able of resisting the horizontal forces given in the Table 4.11.6-3 when applied at the height shown.

Table 4.11.6-3: Design Guidance

Building category and location		**Horizontal load**	**Height (h)**
Single family dwellings	Stairs, landings, ramps, edges of roof	0.36 KN/m	900mm for all elements
	External balconies and edges of roof	0.74 KN/m	1100mm
Factories & Warehouses (light traffic)	Stairs, ramps	0.36 KN/m	900mm
	Landing and edges of floor	0.36 KN/m	1100mm
Residential, Institutional, Educational, Office and public buildings	All locations	0.74 KN/m	900mm for flights otherwise 1100mm
Assembly	530mm in front of fixed seating		800mm(h1)

	All other locations		900mm for flights elsewhere 1100mm(h2)
Retail	All locations	1.5 KN/m	900mm for flights otherwise 1100mm
Other buildings	At opening windows except roof window in loft extensions		800mm
	At glazing to changes of level	To provide containment	Below 800mm

4.11.6.3.5. VEHICLE BARRIERS

4.11.6.3.5.1. Where a vehicle has access to floor, roof or ramp as part of building, there should be provision of barrier to any edge which is on or above the floor or ground or any other place for vehicles.

4.11.6.3.5.2. Any means serving as a barrier should be able of resisting forces specified in Part 6 of this Code and shall be of the following minimum height:

(i) For floor or roof edge: 375mm; and

(ii) For ramp edge: 610mm

4.11.6.3.6. PROTECTION AGAINST FALLING

4.11.6.3.6.1. Stairway (flight of steps) which contains more than three risers shall have prevention on each side provided by a secure wall, railing, screen or balustrade which shall be not less than 1m high and so erected that any such wall, screen, railing or balustrade in any occupancy classified I-2, I-3, R-1, R-3 and R-4 shall not have any opening that permits the passage of a 0.1 m diameter sphere. Provided that such protection in any occupancy not being an occupancy classified I-2, I-3, R-1, R-3, R-4 and R-5 shall consist of at least a handrail and one other rail midway between such handrail and the stair tread:

(i) Any stairway (flight of steps) which contains more than five risers shall be provided with at least one continuous handrail extending the full length of such flight. This condition shall not apply to any building classified R-4 or R-5;

(ii) Any handrail shall be securely fitted to such wall, screen, railing or balustrade at a height of not less than 850mm and not more than 1m measured vertically from the pitch line to the upper surface of the handrail; and

(iii) Handrails shall be provided on both sides of flight and such flight which is less than 1.1m wide shall have a handrail on at least one side and where the width of any flight is more than 1.1m.

SECTION 7: LIFTS & ESCALATORS

4.11.7.1. LIFT

4.11.7.1.1. GENERAL REQUIREMENTS

4.11.7.1.1.1. All building comprising 4 or more floors above the ground level shall be provided with one or more passenger lifts.

4.11.7.1.1.2. The installation shall be accepted in consistency with 'Fire and Life Safety' and local fire regulations and rules there under wherever they are in force.

4.11.7.1.1.3. For buildings with more than 12 floors, where passenger and service lifts are provided in one lobby, there shall be a group control for all the lifts.

4.11.7.1.1.4. Any lift, including walls, screens, balustrades, wells, or shafts to lift shall be designed and constructed so as to sustain dead and imposed loads or any other forces to which it may be subjected.

4.11.7.1.1.5. Machine rooms shall be ventilated. They shall be such that the motors and equipment as well as electric cables etc, are protected as far as possible from harmful dusts and humidity. The ambient temperature in the machine room shall be maintained between 5°C and 40^0C.

4.11.7.1.1.6. Hospital bed lifts should be situated opportunely near the area and operating theatre entrances. There shall be sufficient space near the landing door for easy movement of stretcher.

4.11.7.1.1.7. The corridor should be wide enough to allow enough space for waiting passengers as well as for through passengers.

4.11.7.1.1.8. For the purpose of this Code, risers shall be constant throughout a flight and shall be measured vertically from the top of the next tread.

4.11.7.1.1.9. The provision of a passenger lift shall have the following facilities:

(i) There must be a clear landing not less than 1500mm by 1500mm in front of the lift entrance doors;

(ii) The lift door or doors must provide a clear opening width of at least 800mm;

(iii) The lift shaft must be at least 1100mm wide and 1400mm long;

(iv) The controls must be sited between 900mm and1100mm above the lift floor and at least 400 mm from the front wall;

(v) The lift insulation must be provided with tactile call buttons (both in Braille and raised numbers/letters) on each storey served, and within the lift, tactile storey selector buttons and, in a lift serving more than two storeys, visual and voice indicators of the storey reached;

(vi) A flashing red light should be installed inside the lift to warm deaf persons of fire within the building; and

(vii) Touch sensitive, illuminated and audible lift controls with embossed digits should be used both inside and outside the lift. These should be positioned no higher than 0.9m and 1.1m above the floor. Embossed numerals should also be used to identify the floor number level.

4.11.7.1.2. INSTALLATION OF LIFT

4.11.7.1.2.1. The lift installation shall be done by the property owner and it shall be his/her responsibility where the lift will be installed to find required authorization from the Authority before and after the erection of lifts and for subsequent operation of lift(s).

4.11.7.1.2.2. No person shall without the permission of the Authority install any man lift or any other means of vertical transportation of passengers or goods.

4.11.7.1.2.3. All lifts shall be enclosed in shafts or wells and constructed in reinforced concrete or any other approved fire-resisting materials, except in panoramic lifts.

4.11.7.1.2.4. The installation of passenger lifts, service or goods lifts shall be in accordance with relevant part of ISO 4190.

4.11.7.1.3. POSITION OF LIFT

4.11.7.1.3.1. The position of lifts shall be conventional to the travel distance necessities specified in 'Fire and Life Safety.

4.11.7.1.3.2. The lifts should be simply reachable from all entrances to the building. For maximum efficiency, they should be grouped near the Centre of the building. It is preferably not to have all the lifts out in straight line and, if possible, not more than three lifts should be arranged in this manner.

4.11.7.1.3.3. The position of lifts in factories, warehouses and similar buildings should be planned to suit the progressive movement of goods throughout the buildings, having regard to the nature of position of the loading proposal, railway sidings, etc. The placing of a lift in a fume or dust laden atmosphere or where it may be exposed to extreme temperatures, should be avoided wherever possible.

4.11.7.1.4. ENCLOSURE, MACHINE ROOM, PULLEY, AND MOTOR LOCATION

4.11.7.1.4.1. The motors and equipment as well as electric cables etc, shall be isolated as far as possible from dust, harmful dusts and humidity.

4.11.7.1.4.2. The Machine room shall be soundly constructed, weather-proof and dry. It shall be safe for access by maintenance personnel to all equipment.

4.11.7.1.4.3. The motor chamber or any enclosure housing lift- operating gear shall be, resistant to moisture; completely enclosed with approved incombustible materials and Cross-ventilated or sufficiently ventilated to the satisfaction of the working group.

4.11.7.1.4.4. Machine or pulley rooms shall be used only for accommodating the equipment necessary for the operation of a lift; fire sprinklers shall not normally be fitted in these rooms.

4.11.7.1.4.5. The motor room shall be cross-ventilated and, shall be proved with a permitted window space, which shall open directly into the external air.

4.11.7.1.4.6. Machine rooms shall preferably be placed above a well and room floors finish shall be of non-slip material.

4.11.7.1.4.7. The dimensions of machine rooms shall be sufficient to permit easy and safe access for maintenance personnel to all components, especially the electrical equipment in the machine rooms.

4.11.7.1.4.8. All machine rooms should be measured as plant space, and conditions provided to permit reliable operation of electrical switchgear and rotating machinery, and be favorable to good maintenance. Lighting should be clearly enough around the controller and machine.

4.11.7.1.4.9. Machine rooms should also be weatherproof , the machine room walls, ceiling and floor should be faced in dust-resisting materials, tiles, etc, or painted as a minimum to stop dust circulation which otherwise could damage rotating machinery and cause failure of switchgear.

4.11.7.1.5. MACHINE AND PULLEY ROOM ACCESS

4.11.7.1.5.1. Access for persons to machine or pulley rooms shall be effected entirely by way of stairs if the difference in levels so requires. If it is impractical to install stairs, then ladders may be used.

4.11.7.1.5.2. Access to machine and pulley rooms shall be from common areas without necessitating entry into private premises. A clear and safe access shall be maintained at all times and in all circumstances. The access ways to the machine rooms and the entrances themselves shall be at least 2m high provided that door sills and edges with a height not exceeding 400mm are permitted.

4.11.7.1.5.3. Means of access shall be provided for hoisting of heavy equipment during erection and, if need be, its replacement, so that this can be done safely, especially avoiding handling on stairs.

4.11.7.1.5.4. The Machine room shall be accessible for maintenance and inspection purposes.

4.11.7.1.6. OPERATION OF LIFT

4.11.7.1.6.1. The operation of passenger lifts, service or goods lifts shall be in accordance with ISO 4190.

4.11.7.1.6.2. No person shall without the permission of the building concent authority operate any man lift or any other means of vertical transportation of passengers or goods.

4.11.7.1.7. LIFTWELL

4.11.7.1.7.1. Each well shall be totally enclosed by imperforate walls, floor and ceiling and a lift well shall be exclusively used for a lift.

4.11.7.1.7.2. Walls floor and ceiling of a liftwell:

(i) The structure of a well shall be able to support at least the loads which may be applied by the machine, by the guides at the moment of safety gear operation, or in the case of off-centering of the load in a car, by the action of buffers, or those which may be applied by an anti-rebound device; and

(ii) The walls, floor and ceiling of a well shall be constructed of non-combustible and durable material which do not assist the creation of dust and shall have sufficient structural strength.

4.11.7.1.7.3. Outside of a liftwell:

(i) Every landing entrance shall incorporate a sill of sufficient strength to withstand the passage of load being introduced into a car;

(ii) A slight counter slope shall be provided in front of each landing sill to avoid water from washing, sprinkling, draining or entering into a well;

(iii) On the outside of a well at each landing level, as near as practical to the landing door or, where there are two or more adjoining lifts, the landing door of one in every two lift, there shall be displayed a notice in

Kinyarwanda and English in letters and characters not less than 15mm high as follows: when there is a fire do not use the lift; and

(iv) Sign for passenger lifts: There should be a sign that indicates where the passenger lift is and the sign shall be clearly visible.

4.11.7.1.7.4. VENTILATION OF A LIFTWELL

(i) A well shall be suitably ventilated. It shall not be used to provide ventilation of rooms other than those for the service of lifts; and

(ii) Openings shall be made at the top of a well, with a minimum area of 1% of the area of the horizontal cross section of the well, ventilating to the open .air either directly or via ducting or the machine or pulley room, provided that in no case the ventilation openings shall be less than 0.15m^2 net free area.

4.11.7.1.8. LIFT PIT

4.11.7.1.8.1. An access door shall be provided to the pit if the pit depth exceeds 1.6 m and if the layout of the building so permits.

4.11.7.1.8.2. The lower part of a well shall consist of a pit, the bottom of which shall be smooth and approximately level, except for any bases for buffers, guides and jacks and for water drainage devices. After building the guide fixings, buffers or any grids, the pit shall be impervious to infiltration of water.

4.11.7.1.8.3. Where an access door is provided it shall:

(i) Have a minimum height of 1.4m and a minimum width of 600mm; and

(ii) Bear on its outside face a notice in English and also in Kinyarwanda in letters and characters not less than 25mm high.

4.11.7.1.9. INSPECTION OF LIFT

(iii) Inspection doors shall have a minimum height of 1.4m and a minimum width of 600mm;

(iv) Inspection doors, emergency doors and inspection traps shall be provided with a key-operated lock, capable of being reclosed and relocked without a key;

(v) Emergency doors shall have a minimum height of 1.8m and a minimum width of 500mm. In addition the emergency doors shall: be located in a position readily accessible to rescuers; and bear on its outside face a notice in Kinyarwanda and English in letters and characters not less than 25mm.

(vi) Inspection and emergency doors shall be capable of being opened from inside the well without a key even when locked.

4.11.7.1.10. MAINTENANCE OF LIFT

4.11.7.1.10.1. The lift installation (wire ropes, groove of drums, sheaves and pulleys) should receive regular cleaning, lubrication, adjustment and adequate servicing by authorized competent persons at such intervals as the type of equipment and frequency of service demand. In order that the lift installation is maintained and inspected at least once every six months by competent lift engineer and a certificate by such engineer to the effect that the whole installation is in safe working order.

4.11.7.1.10.2. A log book to record all items relating to general servicing and inspection is recommended for all lifts. It is essential that the electrical circuit diagram of the lift with the sequence of operation of different components and parts should be kept readily available for the persons responsible for the maintenance and replacement where necessary.

4.11.7.1.10.3. The following signals should be given to the building management interface from each lift: Alarm button in car, floor level information, lift moving information, Power on information, and Lift position information.

4.11.7.1.11. QUANTITY, CAPACITY AND SPEED OF LIFT

4.11.7.1.11.1. Without contradicting the requirements of the relevant part of ISO 4190, the recommended minimum size of car for a single purpose building is one suitable for a duty load of 884 kg. Generally, for large office buildings cars with capacities up to 2040kg are recommended according to the requirements.

4.11.7.1.11.2. The following shall be the guiding factor for determining this aspect:

Quality of Service		Floors		Speed
20 to 25 seconds:	→ Excellent	4 to 5	→	0.5 to 0.75 m/s
30 to 35 seconds:	→ Good	6 to 12	→	0.7 to 1.5m/s
34 to 40 seconds:	→ Fair	13 to 20	→	1.5 to 2.5m/s
45 seconds	: → Poor	Above 20	→	2.5 and above
Over 45 seconds:	→ Unsatisfactory			

4.11.7.1.12. FIRE CONSIDERATIONS

4.11.7.1.12.1. For all buildings, the controls of any lift shall be so designed that, in the incident of fire, such lift shall be brought automatically to the main entrance storey with no stopping and shall remain there with its doors open.

4.11.7.1.12.2. Since building has more than 10m in height, where a lift or bank of lifts is not provided with a lobby, the lift doors shall be fire rated with a stability and integrity rating of not less than 2 hours and shall be sealed against the ingress of smoke for a minimum of 30min.

4.11.7.1.12.3. If is not in conformity with the requirements, the doors to such lobby shall have self closing mechanisms to automatically close such doors after being opened. If double doors are used, a selector mechanism shall be installed to ensure the correct meshing of any rebate on the meeting styles.

4.11.7.1.12.4. The firemen's lift shall have internal dimensions not less than 1.1m wide by 2.1m deep and have a clear door width of not less than 0.8m, be unmistakably recognized as a firemen's lift on every storey, be stopped at any storey and have contact to all

such floors when needed, be kept accessible for use at all times, be subject to independent control during an emergency, maintain to be useful during an emergency when all other lifts have been brought to the main entrance floor.

4.11.7.1.12.5. Firemen's lift shall be provided with a source of emergency power which will enable such lift to operate together with its lights and extraction fan for not less than 120min in the event of failure of the mains supply.

4.11.7.1.12.6. It shall be also provided with means of oral contact to a control point or to a control room where such a room is provided and it shall have doors that open into the lobby and be provided with door closers that are designed to assist entrance by a person seated in a wheelchair.

4.11.7.1.12.7. It shall be designed and prepared in such a way that provision is made for the lift to be lowered, by alternative means, in a controlled manner to ground in the event of failure of emergency power and have Manual alarms, designed, installed and maintained by competent persons and that are in the backstage area in easily available arrangement.

4.11.7.1.12.8. In a building that exceeds 30m in height or that is more than 12.5m below the level of escape, at least one firemen's lift shall be provided to serve all floors.

4.11.7.1.12.9. Emergency lifts: At least one emergency lift must be installed in a building which has an effective height of more than 25m and a building in which patient care areas are located at a level that does not have direct egress to a road or open space.

4.11.7.1.13. LIFT FOR PERSON WITH DISABILITIES

4.11.7.1.13.1. Lift should be provided with access to all floor to enable persons with disabilities to have access throughout the building, exceptions may be considered in certain circumstances.

4.11.7.2. ESCALATORS

4.11.7.2.1. GENERAL REQUIREMENTS

4.11.7.2.1.1. An unrestricted area shall be provided at each landing of an escalator to accommodate passengers.

4.11.7.2.1.2. No escalator shall form part of any emergency route.

4.11.7.2.1.3. Where an escalator is installed in any building, it shall be in addition to any staircase and the means of escape in case of emergency

4.11.7.2.1.4. The installation and operation of escalators whether for the vertical or horizontal transportation of passengers or goods shall be in accordance with relevant part of ISO 4190.

4.11.7.2.2. SATISFACTORY PERFORMANCE OF ESCALATORS

4.11.7.2.2.1. Angle of inclination of an escalator from the horizontal shall not exceed 30° for a rated speed not exceeding 0.75m/s, but for rises not exceeding 6m and rated speed not exceeding 0.5m/s the angle of inclination is permitted to be increased up to 35°.

4.11.7.2.2.2. Each balustrade shall be provided with a handrail moving in the same direction and at substantially the same speed as the steps.

4.11.7.2.2.3. The truss or girder shall be designed to safety sustain the steps and running gear in operation. In the event of failure of the track system it shall retain the running gear in its guides.

4.11.7.2.2.4. Step, wheel tracks shall be designed to prevent displacement of steps and running gear if a step chain breaks.

4.11.7.2.2.5. The driving machine shall be connected to the main drive shaft by toothed gearing, a coupling, or a chain and an electric motor shall not drive more than one escalator.

4.11.7.2.2.6. The landing area of escalators shall have a surface that provides a secure foot hold for a minimum distance of 0.85m measured from the root of the comb teeth.

4.11.7.2.2.7. There shall be a comb plate at the entrance and at the exit of every escalator. The comb plate teeth shall be meshed with and set into the slots in the tread surface so that the points of the teeth are always below the upper surface of the treads. Comb plates shall be adjustable vertically

SECTION 8: SECURITY SYSTEMS

4.11.8.1. GENERAL REQUIREMENTS

4.11.8.1.1. Security systems shall be composed of an integrated closed circuit television system (CCTV), access control system (including but not limited to manual and automatic), perimeter protection systems, movement sensors, etc

4.11.8.1.2. The security systems shall be connected to the emergency power supply.

4.11.8.1.3. The cables placed in underground ducts and outside of buildings shall be rated for outdoor use with water blocking members.

4.11.8.1.4. The security system shall have a main central control panel located near the fire detection and alarm system.

4.11.8.1.5. Suitable security systems shall be considered for high security areas or public buildings. For residential/private buildings, the owners shall ensure security systems as the may deem appropriate.

4.11.8.1.6. Installation of all security systems shall be in accordance with the manufacturer's specifications and installation procedures of alarm closed circuit television and security system shall comply with relevant updated national or international standard.

4.11.8.1.7. The protected space shall be provided with a complete intrusion alarm system that shall be provided by way of appropriate technologies. The intrusion alarm system shall be designed to detect unauthorized entry into protected spaces and all specifications for their design shall comply with IEC 62642-2-2.

4.11.8.2. CLOSED CIRCUIT TELEVISION (CCTV) SYSTEMS

4.11.8.2.1. The closed-circuit television systems shall not violate the rights of privacy and other legal rights of persons under observation. In particular, signs shall be provided where routine surveillance is conducted, advising that the space is under electronic surveillance. Signage shall be in the one of languages spoken in the country.

4.11.8.2.2. Surveillance system including closed circuit television with control room shall be installed in following occupancies: A, B, F, I, M, R-1 and R-2.

4.11.8.2.3. Cameras shall not be installed where there is a reasonable expectation of privacy such as in washrooms, change rooms or other similar spaces.

4.11.8.2.4. The functional requirement, installation and remote monitoring of detector activated closed circuit television systems shall comply with relevant updated national or international standard.

4.11.8.2.5. CCTV shall be provided with adequate data backup requirement

4.11.8.3. ACCESS CONTROL SYSTEMS

4.11.8.3.1. Access control system shall be installed in protected space based on occupancy security requirements.

4.11.8.3.2. Access control shall be provided for entry to high security areas including stairwell doors at points of public access. The walk through, luggage scanners, handheld metal detectors shall be provided for the following occupancies: A, B, E, F, I, M, R-1, R-2, R-3, S, MEM, MIX and MISC.

4.11.8.3.3. The systems requirement, general design principles and application guidelines for access control systems shall comply with ISO/IEC 27034.

4.11.8.4. PERIMETER ALARM SYSTEMS AND MOVEMENT SENSORS

4.11.8.4.1. The perimeter Alarm Systems for physical and environmental security shall be used to prevent unauthorized physical access or damage to individual or organization.

4.11.8.4.2. The choice of equipment, design and installation of perimeter alarm systems shall comply with ISO/IEC 27001

4.11.8.4.3. The quality management systems of movement sensors including transmitters, switches and their type's selection shall comply with relevant part of ISO 17799

SECTION 9: TELECOMMUNICATION INSTALLATIONS

4.11.9.1. GENERAL REQUIREMENTS

4.11.9.1.1 The promotion of information communication technology within the Housing Industry by subscribing to data (text and picture), video and voice communication at high bandwidth shall be an integral component of building construction in Rwanda.

4.11.9.1.2 The requirements of telecommunication facilities like Telephone connections, Private Branch Exchange, Intercommunication facilities, Internet Broadband Connection shall be planned well in advance so that suitable provisions are made in the building plan in such a way that the demand for telecommunication services in any part of the building at any floor are met at any time during the life of the building.

4.11.9.1.3 The design of information communication technology cabling infrastructure should be carried out by firms specialized in the matter, those that can demonstrate sufficient expertise with passed professional accomplishments.

4.11.9.1.4 The design of regular housing should be done in such a way as the connection to Information Communication Technology, Internet Broadband inclusive can be done with ease.

4.11.9.1.5 Service Providers shall not be responsible for internal networking when it comes to the extension or the sharing of the connection. The service line will usually terminate to a network unit located at ground floor of the building and during architectural design communication cabling must be taken into account for most of the buildings along with electrical installation design.

4.11.9.1.6 The size, complexity and purpose of the local area network shall vary depending upon the kind of building (industrial, residential, commercial, administration and the design should limit itself to passive network components (cabling) providing the possibility to make interconnection later using active components (switches, router) according to the occupant need after building construction completion.

4.11.9.1.7 Building designer shall therefore contact the network operators during the planning stage of new buildings in order to consolidate the requirements of telecommunications and broadcasting systems installations.

4.11.9.2. TELECOMMUNICATIONS PATHWAYS

4.11.9.2.1. When designing a telecommunications pathway system, the design diagram shall accommodate the cabling change, minimize the occupant disruption when pathways are accessed and facilitate the ongoing maintenance of cabling.

4.11.9.2.2. The designer shall locate telecommunications pathways away from sources of electromagnetic interference complying with ITU-T recommendation K.26.

4.11.9.3. CABLING NETWORK SYSTEMS REQUIREMENTS

4.11.9.3.1. The design, planning and construction practices of cabling network systems shall comply with ISO/IEC 18010.

4.11.9.3.2. Conduits, ducts, channeling and trucking systems shall be separately provided for the electrical power supply cables, telecommunications cables and in-building coaxial cable distribution system cables in accordance with ITU-T recommendation L in conjunction with relevant parts of RS EAS 811.

4.11.9.3.3. For metal duct system including the conduits, ducts, pipes, trucking, they shall be fully bonded and earthed complying with ITU-T recommendation K.27.

4.11.9.4. DISTRIBUTION FRAMES AND TELECOMMUNICATIONS EQUIPMENT ROOM

4.11.9.4.1. Building distribution frame shall not share room with electrical distribution; transformers to avoid the threat of damage or electromagnetic frequency interference. The designer shall be required to refer to and comply with telecommunication installation standards for room design parameters including architectural elements, mechanical, & electrical requirements.

4.11.9.4.2. The building main distribution frame, and the intermediate distribution frame, shall be shared with both access control and fire alarm. There shall be a minimum of one Telecommunications room per floor and the rooms shall be vertically aligned where possible.

4.11.9.4.3. Existing building distribution frame/ intermediate distribution frame that need expansion in order to comply with the new standard shall meet the electronic industries alliance standards specifications for a communications room and equipment not related to the support of the telecommunication equipment room (e.g. piping, ductwork, pneumatic tubing,) shall not be installed in, pass through, or enter the telecommunication equipment room.

4.11.9.4.4. The telecommunication equipment room shall be located in center of building and shall be stacked directly above and below each other floor to floor. Telecommunication equipment room shall be located so that access is made directly from a public or common hallway and access shall not interrupt normal business or workflow of occupants.

4.11.9.4.5. The ceiling shall be free and clear of any obstructions including architectural / structural members not directly related to the telecommunication equipment room.

4.11.9.4.6. No acoustical or false ceilings lay in tile, or suspended ceiling grid shall be permitted in the telecommunication equipment room or any other areas designed or designated for the distribution of communications cabling or equipment.

4.11.9.5. ELECTRICAL POWER SUPPLY REQUIREMENTS

4.11.9.5.1. It is highly recommended that the electrical feed to the telecommunication equipment room shall have a power backup supply and shall include all convenience outlets.

4.11.9.5.2. When building backup power source is provided to the building, all power, including power to all mechanical systems, in the telecommunication equipment room shall be installed to the buildings backup power source. All electrical outlets hooked to the generator shall be red in color with red faceplates. Circuit identification shall be labeled on faceplate.

4.11.9.5.3. A separate supply circuit serving the telecommunication equipment room shall be provided and terminated in its own electrical panel inside the telecommunication equipment room.

4.11.9.5.4. Care shall be taken to avoid the connection of regular building lighting loads to an electrical panel dedicated to telecommunication equipment supply.

4.11.9.6. COMMON ANTENNA SYSTEM FOR TELEVISIONS RECEIVERS

4.11.9.6.1. In multistoried apartments, houses and hotels where many television receivers are located, a common master antenna system shall preferably be used to avoid mushrooming of individual antennas and shall be generally provided at the top convenient point.

SECTION 10: PLUMBING& DRAINAGE

4.11.10.1. GENERAL REQUIREMENTS

4.11.10.1.1. All plumbing in connection with any building shall be in accordance with the regulations for sanitary installations in buildings, or any other established practice acceptable by the Authority.

4.11.10.1.2. All drainage of foul and wastewater in connection with any building shall be in accordance with the Regulations for Sanitary Installations in Buildings or any other established practice acceptable by the Authority.

4.11.10.1.3. Where there is a piped water supply system capable of providing not less than 75 litres per person per day, a building shall have a water-borne system of excreta disposal within the curtilage of the site or the owner of the building shall install the said system.

4.11.10.1.4. Whenever a water supply distribution system capable of providing not less than 75 litres per person per day becomes available in any area where a building is situated, the Authority shall serve notice on the owner of the building to convert the existing method of excreta disposal to a water-borne system.

4.11.10.1.5. Installation, repair and replacement of gas piping or appliances shall be performed only by a qualified installing firm or person.

4.11.10.2. ROOF TOP DRAINAGE AND WATER HARVESTING

4.11.10.2.1. Appliances for drainage shall be provided to the roof of a building to prevent rain which may fall upon it and from causing dampness in any part of the building.

4.11.10.2.2. Every building shall be designed so that rain water will not be discharged upon a street as run off.

4.11.10.2.3. Every building shall be provided with rain water harvesting system in accordance with RS 187

4.11.10.2.4. The size of cross-section of gutters and downpipes for roof drainage shall be proportional to the area of the roof surface as specified in Table 4.1.10-1 below.

Table 4.1.10-1: Minimum Cross-Section Area

Material	Minimum Cross-Section	Roof Plan Area
Gutter	$115mm^2$	$1m^2$
Downpipe	$100mm^2$	$1m^2$

4.11.10.2.5. Materials used in the installation of rooftop harvesting system shall be resistant to corrosion, both inside and outside, free from hazardous materials or shall be suitably protected against corrosion and also free from asbestos.

4.11.10.2.6. All materials, water fittings and appliances shall conform to Part 7, Section 1 for building materials of this code and shall be in accordance with RS ISO 2531 for iron materials.

4.11.10.2.7. Precautions shall be taken during rain water harvesting to avoid its contamination by chemicals, bacteria, and other harmful substances. Especially in urban areas and other area that are prone to pollution, the water is to be used for flushing of toilets and cleaning, otherwise it should be treated for drinking.

4.11.10.2.8. Where there are rain water harvesting for buildings in groups of occupancies A-1, A-2, A-5, E-1, I-1, I-2, I-3,M-3 and R-3; there shall be the use of rain water collection in grounds of institutions, storage in underground reservoirs thereafter treatment and then use for non-potable applications can be applicable.

4.11.10.2.9. The rain water collected shall be stored in a clean, corrosion resistant, free from asbestos tank or reservoir and shall comply with relevant approved standards for water retaining structures depending on its materials such as RS EAS 783 for stainless steel tanks and RS 128 rotational moulded polyethylene water storage tanks.

4.11.10.2.10. The overflow shall be drained properly into an approved surface channel where storm water is controlled to flooding of buildings. There shall be desirable reservoirs which are reserved for storing such excess water.

4.11.10.2.11. In mixed use occupancy, the overflow shall be drained in a general collection center and thereafter used for different activities.

4.11.10.2.12. Free water from accidental overflow from sanitary fixtures or sanitary appliances must be disposed of in a way that avoids loss of amenity or damage to household units or other property.

4.11.10.3. STORM WATER DISPOSAL

4.11.10.3.1. An owner of a building shall make provisions for the whole of the building and site to be effectively drained by the construction of storm water, surface water, and subsoil water systems, which shall be connected to an available outfall.

4.11.10.3.2. In all cases where the slope of the ground is steeper than 1:20, the owner shall construct a cut-off drainage system.

4.11.10.3.3. The cut-off drain shall be earthen or precast units, in-situ concrete or any other materials as approved by the Authority.

4.11.10.3.4. The design of the drain shall be based on the slope of the ground, the area of the immediate watershed of the drain, and the maximum intensity of rainfall in the catchment area.

4.11.10.3.5. The drainage installation shall be constructed and maintained at the cost of the owner, and where the drain is common to two or more plots it shall be constructed and maintained jointly by the owners of plots served by the drain.

4.11.10.3.6. The size, slope, and outfall location and design of any drain, whether individual or common, shall be submitted for approval by the Authority office in accordance with the provisions of location plan in the requirements for building application.

4.11.10.3.7. The Authority may, notwithstanding the installations on the approved plans, order the installation of additional storm water, surface water, or subsoil water drainage system on the plot in order to prevent the breeding of mosquitoes or remove any nuisance or hazard the Authority office may determine exists.

4.11.10.3.8. A drainage system for surface water from the roof of any building or paved surfaces shall conform to the requirements of the Regulations for Sanitary Installations in Buildings or to any approved building practice.

4.11.10.3.9. A roof of any building and of any profile, or any other surface susceptible to rainfall such as canopies, carports, balconies or terraces, shall be constructed to drain effectually to suitable gutters to carry water away from the building and any doorway, window or walkway, except where an apron of concrete or other approved impervious material shall be provided to protect the foundations and the building, and the water can be prevented from entering the building, doorway or window, or falling on any walkway.

4.11.10.3.10. Where a gutter has been provided, it shall be connected to a sufficient number of down pipes which shall be sized and located to carry away any water which may fall on the roof or any other building surface and discharge it into approved drainage without causing dampness in any wall, foundation, opening, or walkway of the building.

4.11.10.3.11. An apron constructed pursuant to sub-regulation 4.11.10.4.9 of this Code, shall be sloped away from the plinth of the building and shall discharge into a surface channel drain or any other approved drainage system.

4.11.10.3.12. All water collected from any roof or paved area shall be carried off the curtilage of any building in the manner approved by the Authority.

4.11.10.3.13. The owner of a building or premises shall maintain all gutters and down pipes on the premises free of any blockage or obstruction, and the water shall not stagnate or accumulate in the gutters or down pipes.

4.11.10.3.14. Eave gutters and down pipes shall be made of galvanized iron, mild steel, concrete or cast iron, approved by the Authority, and shall be coated or lined with a durable material.

4.11.10.3.15. An eaves gutter shall be supported by suitable means spaced at not more than 1.0 meter centre to centre and shall be properly aligned to have a continuous and evenfall to the point of discharge, which shall be located to serve every 10.0 meters in the length of the eaves gutter.

4.11.10.3.16. Down pipes or gutters on any building shall not project beyond the limits of the plot on which the building is erected.

4.11.10.3.17. In all cases the plumbing or drainage installation of any building shall be constructed to the satisfaction of the Authority and the installation shall not be used by the owner of the building prior to approval.

4.11.10.3.18. No drain, surface channel, or any other means of conveying rainwater or surface water shall discharge into a septic tank.

4.11.10.4. WATER SUPPLY

4.11.10.4.1. In urban area, every building in which people live, work or congregate shall be provided with a supply of clean, cool and portable water in sufficient quantity to maintain all water supply and plumbing fixtures in a safe and sanitary manner, and such other water supplies as are required for fire protection, air conditioning and all other service equipment of the building or structure required by this Code.

4.11.10.4.2. In rural areas, every building shall have access to water supply in the distance less than 500m.

4.11.10.4.3. Buildings provided with water outlets shall have safe and adequate water supplies; and the supply system shall be protected from contamination by using components that will not contaminate the water.

4.11.10.4.4. For a non-potable water supply system used for personal hygiene shall be installed in a manner that water pipes and outlets provided with non-potable water must be clearly identified.

4.11.10.4.5. Cross connection shall not be made between clean water distribution system and any portion of waste or soil systems, or fixtures or devices that will contaminate, pollute or otherwise render the water unsafe.

4.11.10.4.6. All the works of water supply facilities in the addition or alteration for the existing building shall also require a permit to the authority for their installation.

4.11.10.4.7. All plumbing work for building services shall be executed only by a qualified plumber and shall be responsible to carry out the work acoording to the provisions of this Code.

4.11.10.4.8. In building planning, provisions shall be made to meet the water supply requirements for firefighting in the area depending on the population density and type of occupancy and shall comply with part 3 of this Code.

4.11.10.5. WATER SUPPLY SYSTEM

4.11.10.5.1. Building service supply shall be unlawful to connect water piping supplied directly from city water mains. But for continuous water supply system with sufficient pressure to feed all plumbing fixtures during peak demand period, the direct connection of water distribution system to the water mains may be adopted.

4.11.10.5.2. For water supply system with inadequate pressure to feed plumbing fixtures or balancing roof tank, the building premises shall have a ground (or underground) tank to store water. The water from the ground tank shall be boosted up to the roof tank to feed plumbing fixtures.

4.11.10.5.3. The design of the pipe work shall be provided with backflow prevention device which shall be installed as near as practicable to each point of delivery and use of water. All backflow prevention devices shall be installed so that they are accessible for repair or replacement; and shall also be capable of being inspected periodically by the Authority to ensure that the device is functioning efficiently and no backflow is occurring at any time.

4.11.10.5.4. The plumbing system shall be subjected to required tests to effectively disclose all leaks and defects in the work or the material.

4.11.10.6. WATER STORAGE

4.11.10.6.1. The type and capacity of a storage tank shall be determined considering the following factors:

(i) The rate and regularity of supply;
(ii) The frequency of replenishment of the storage tank during 24 hours;
(iii) Building occupancy classification;
(iv) Hours of supply of water at sufficiently high pressure to fill up the roof storage tank in absence of a ground (or underground) storage tank; and
(v) The amount of water required by special equipment.

4.11.10.6.2. Storage tank shall be easily accessible for inspection and cleaning; and shall be provided with adequate size of valved drains at its lowest point in accordance with Table 4.1.10-2.

Table 4.1.10-2: Sizes of Storage Tank Drainage Pipes

Tank Capacity (m^3)	**Diameter of Drainage Pipe (mm)**
V≤ 2800	25
2800 < V≤ 5500	38
5500 < V≤ 11000	50
11000< V≤ 19000	63
19000< V≤ 28000	75
28000< V	100

4.11.10.6.3. The water supply inlet into the storage tank shall be at an elevation with an air gap in an open tank with overflow or 100mm above the overflow whichever is greater.

4.11.10.6.4. The diameter of overflow pipe shall be proportional to the specific discharge into the storage tank as described in Table 4.1.10-3.

Table 4.1.10-3: Sizes of Overflow Pipes for Storage Tank

Maximum Discharge (Q) of Water Supply Pipe into Storage Tank (liter/minute)	**Diameter of Overflow Pipe (mm)**
$Q \leq 190$	50
$190 < Q \leq 570$	63
$570 < Q \leq 760$	75
$760 < Q \leq 1500$	100
$1500 < Q \leq 2650$	125
$2650 < Q \leq 3800$	150
3800 < Q 50	200

4.11.10.6.5. The storage tank shall be equipped with water tight and rodent proof cover. The tank shall be provided with return bend vent pipe with an open area not less than half the area of the riser.

4.11.10.6.6. The roof storage tank shall be constructed with materials that will resist any action by the plain or chlorinated water. Tanks made of non-galvanized metal sheets shall be coated internally with a nontoxic material which does not impart a taste or odour. The metal storage tank shall be coated externally with a good quality anticorrosive weather resistant paint.

4.11.10.6.7. The bottom of the tank shall be elevated sufficiently above the highest floor water fixtures to provide sufficient pressure.

4.11.10.6.8. Vent pipe shall be provided to avoid any air lock and shall be placed where the horizontal branch pipes connect the vertical down feed pipes.

4.11.10.6.9. For ground or underground tank, its location shall be selected so as to avoid contamination by flood water or any other sources. Each compartment/units shall be divided in two chambers with provision of sump for longer contact time with chlorine and easy cleaning.

4.11.10.7. PIPING AND FITTING

4.11.10.7.1. The materials and fittings for water supply and distribution pipe and for storage tank shall comply with Part 7 of this Code for building materials.

4.11.10.7.2. The materials chosen shall be resistant to corrosion, both inside and outside or shall be suitably protected against corrosion and free from all toxic, harmful substances and asbestos.

4.11.10.7.3. Polyethylene and unplasticized PolyVinyl Chloride pipes shall not be installed near hot water pipes or near any other heat source.

4.11.10.7.4. The pipes, fittings and valves shall be in accordance with relevant part of RS ISO 1452 or any other relevant national standards for plastics and piping system for water supply.

4.11.10.7.5. Ductile iron pipes, fittings, accessories and their joints for water applications shall comply with RS ISO 2531.

4.11.10.7.6. Where the normal water supply cannot achieve the flow and pressure, a pump shall be installed to provide them.

4.11.10.7.7. All sanitary appliances that require water shall be supplied with sufficient and clean water.

4.11.10.7.8. Pipes laid underground shall have a soil cover over the outside at least 450mm for any pipe of nominal diameter less than 75mm or 750mm for any pipe of nominal diameter 75mm and above to protect any such pipes against transformation of excessive superimposed loads direct to the pipes. Pipes that are laid under heavily trafficked roads shall have highly performing protection.

4.11.10.8. HOT WATER SUPPLY

4.11.10.8.1. Hot water supply installation

4.11.10.8.2. For a residential building, hot water may be supplied to all plumbing fixtures and equipment used for bathing, washing, cleansing, laundry and culinary purposes. For a non residential building, hot water may be supplied for bathing and washing purposes.

4.11.10.8.3. In modern hotels and apartment blocks and service apartments, centralized storage and distribution systems are adopted, where other energy sources such as oil, gas, solar panels, etc, may be used for the generation of hot water as these options prove more economical and convenient in heating large volumes of water for storage.

4.11.10.8.4. A hot water system must be capable of being controlled to prevent the growth of legionella bacteria.

4.11.10.8.5. The source energy used by water heater shall be commonly those recommended by the approving Authority to be economical such as gas, solar, oil and wind and electricity on a small range.

4.11.10.8.6. The design of hot water supply system and its appliances shall be based on the temperatures at which water is normally required for the various uses, namely:

(i) Hot bath 41°C;
(ii) Scalding 65°C;
(iii) Sink 60°C;
(iv) Tepid bath 30°C; and
(v) Warm bath 37°C.

4.11.10.8.7. The size and capacity of hot water storage vessel shall be governed by the maximum short time demand of the domestic premises.

4.11.10.8.8. Vessels used for producing or storing hot water must be provided with safety features that relieve excessive pressure during both normal and abnormal conditions; and limit temperatures to avoid the likelihood of flash steam production in the event of rupture.

4.11.10.8.9. Hot water heater shall be installed following the relevant national standard and tested in accordance with RS 214, IEC 60335-2-21 and IEC 60379.

4.11.10.9. HOT WATER PIPING

4.11.10.9.1. Every hot water heater shall be provided with a vent pipe of not less than 20mm bore. The vent pipe shall be connected to the highest point of the heater vessel and it shall not project downwards inside it, as otherwise air may be trapped inside, resulting in surging and consequent noises.

4.11.10.9.2. Distribution pipes shall be made of any of the materials conforming to Part 7 of this code and regulation 4.11.10.4.1 of this section like high density polyethylene pipes, galvanized iron pipes, cast iron pipes, and unplasticized PolyVinyl Chloride pipes where it is laid before frost line.

4.11.10.9.3. Hot water distribution pipes shall be surrounded with straw, grass or jute wrapped over with gunny and painted with bitumen for insulation.

4.11.10.9.4. The joint rings for pipelines for hot-water supply up to 110°C and their materials specification shall comply with ISO 9631.

4.11.10.10. GAS SUPPLY

4.11.10.10.1. In buildings where gas is used as an energy source, the supply system and their installations shall be safe and adequate for people and its intended use; and the supply systems shall be constructed to maintain a safe pressure range appropriate to the appliances and the type of gas used.

4.11.10.10.2. Supply systems shall be isolated to the whole installation of apparatus by isolation device which permits the system to be maintained, tested, detected fault or repaired.

4.11.10.10.3. Where gas is supplied from an external source, the supply system within buildings shall be well constructed to avoid the contamination of the external supply from other gas sources within the building.

4.11.10.10.4. The supplied gas shall be protected from adverse effects on the pressure of the external supply, and the external supply pipe acting as an earthing conductor.

4.11.10.10.5. Piping systems shall be identified with markings if the contents are not readily apparent from the location or associated equipment and the pipes shall be protected against corrosion in the environment of their use

4.11.10.10.6. Provision shall be made for the ready removal of moisture or condensate in gas pipes.

4.11.10.10.7. Before turning gas under pressure into any piping, all openings from which gas may escape shall be closed.

4.11.10.10.8. No flame, matches or other sources of ignition shall be employed to check for gas leakage from meters, piping or appliances. Checking for gas leakage with soap and water solution is recommended

4.11.10.10.9. The installation of cylinders, equipment and piping shall be done with qualified persons who understand the characteristics of liquefied petroleum gas.

4.11.10.10.10. Such person shall be trained in good practice of handling, installing and maintaining installations.

4.11.10.10.11. The jointing compound used at different joints in the system shall be decided by the Qualified Installing firm.

4.11.10.10.12. Where liquefied petroleum gas cylinder installations are located, fire extinguishers of dry powder type or carbon dioxide type conforming to accepted standards shall be provided near such installations.

4.11.10.10.13. Handling, storage distribution and maintenance of liquefied petroleum gas in domestic,

commercial, and industrial installations shall comply with RS 135 and relevant part of RS 136.

SECTION 11: WATERBORNE SANITATION

4.11.11.1. GENERAL REQUIREMENTS

4.11.11.1.1. The erection of water closets, urinal or any other fixture for the purpose of disposing excreta, foul or wastewater shall conform to the requirements of the regulations for sanitary installations accepted by the Authority in buildings as well as the drainage of foul and wastewater in connection with buildings.

4.11.11.1.2. The water-borne system for wastewater disposal shall be available in any building which its water supply system is not less than 75 litres per person and the Authority shall oblige to convert any existing means of excreta disposal to water-borne system in any building which has the said water supply per person.

4.11.11.1.3. All drains, drain fittings, foul water or wastewater fittings, pipes, accessories or appurtenances, septic tank and any other wastewater disposal which shall be used in a water-borne system shall comply with the requirements of this Code for sanitary installations in buildings. Such conservancy means to be used on a site for the reception of sewage shall be connected to a public sewer and shall also be cited:

(i) As not to endanger the structure of any building or any services on the site; and

(ii) Be designed and sited that it is not likely to become a source of nuisance or a danger to health.

4.11.11.1.4. Any water-borne system require the water closets to be located inside each building relatively on its occupancy and these last shall be marked in order to specify its user either male or female in accordance with the Authority.

4.11.11.1.5. The method of disposal for a water-borne system shall be by septic tank and soak away, tile field, sub-surface seepage trenches, radial arms, or other approved means of subsurface disposal of effluent, or by conservancy tank, which shall be emptied regularly by a body designated for that purpose or as determined by the Authority.

4.11.11.1.6. All buildings which require a regular cleaning such as washing area, car wash, abattoir, butchery, kennel, cowshed shall be well designed and constructed by suitable materials so as to direct their regular wastewater in the storage designed for that as well as swimming pool and fountain.

4.11.11.1.7. All sanitary fixtures shall be erected of impermeable, non-corrosive material, shall have a smooth and readily cleanable surface and shall be fitted as to discharge through a trap, into a soil pipe or waste pipe, as the case may be.

4.11.11.1.8. Manholes shall be when required positioned as to enable accessibility of wastewater disposal. They shall be provided at every junction and at a defined maximum spacing. They shall be constructed in approved manner by an approved person so as to prevent water entrance in such manhole.

4.11.11.1.9. All sanitary fixtures designated for the use of females, there shall be suitable means provided for the disposal of sanitary towels. Such sanitary fixtures which use electrical machine for hand-washing shall be directed in waste pipe.

4.11.11.2. LIGHTING AND VENTILATION FOR WATER-BORNE DISPOSAL AREA

4.11.11.2.1. Any sanitary facility where foul water are conveyed from a building, shall be properly ventilated with at least one ventilating pipe not less 75mm in diameter, situated as near as practicable to the building and as far as practicable from the point at which the sanitary facility empties into the sewer or other means of disposal.

4.11.11.2.2. All building shall comprise sanitary fixtures; both natural and artificial ventilation, natural and artificial lighting shall be provided with an opening not less than 10% of the floor area of these sanitary fixtures in order to avoid foul air produced by such sanitary fixtures.

4.11.11.2.3. Natural and artificial lighting shall be in suitable manner so as to facilitate the utilization of such sanitary fixtures and the ventilation of wastewater disposal shall be designed according to air orientation in order to prevent foul air to be directed in

living room, food storage and in each room of habitation building or other building designed for a given purpose.

4.11.11.3. WATER CLOSETS AND URINAL

4.11.11.3.1. The construction materials for water closets which use water flushing shall be suitable and adequate for sanitation and shall be partitioned with wall and a door enclosing to ensure privacy.

4.11.11.3.2. The construction and installation of urinals and water closets shall respect the users' privacy; they shall be constructed so as no leakage shall result during its use. The Table 4.11.11-1 provides all specification according to the occupancy classification.

Table 4.11.11-1: Minimum Latrine Accommodation

Function	Users	Population	Provisions of Latrines/ WCs			
			Male			Female
			Without Urinal	With Urinal	Additional Urinal	
EDUCATIONAL BUILDING	Staff	1-15	-	1	-	1
		16-35	-	2	1	2
		36-60	-	3	2	4
	Boarding Students	1-15	-	1	-	1
		16-30	-	2	1	2
		31-75	-	3	2	4
		76-100	-	6	4	8
		101-150	-	8	4	10
		Over 150	-	1 per 30	1 per 25	1 per 50
NURSERY	Pupils		1 per 15	1 per 15	1 per 15	1 per 15
ELEMENTARY SCHOOL	Boys	1-25	2	2	1	-
		26-50	3	2	2	-

		51-75	4	3	2	-
		76-100	5	4	3	-
		101-125	6	5	4	-
		126-150	7	6	4	-
		151-175	8	7	5	-
		176-200	10	8	5	-
		Over 200	1 per 30	1 per 30	1 per 50	-
	Girls	11-20	-	-	-	2
		21-40	-	-	-	2
		41-60	-	-	-	3
		61-80	-	-	-	4
		81-100	-	-	-	5
		101-120	-	-	-	6
		121-140	-	-	-	7
		141-160	-	-	-	8
		161-180	-	-	-	9
		181-200	-	-	-	10
		Over 200	-	-	-	1 per 30
OFFICE OR PUBLIC BUILDING	Persons	1-15	-	1	-	1
		16-35	-	2	-	2
		Over 35		-	1 per 75	-
RESTAURANT	Public, male	1-15	-	1	-	1
		16-50	-	2	-	2
		Over 50	-	2	1 per 40	2
	Public, female	1-50	1	-	-	2
	Staff male	1-15	-	1	-	-
		Over 15	-	-	1 per 75	-
	Staff female	1-12	1	-	-	1

WAREHOUSES, WORKSHOPS AND OTHER WORKPLACES	Male	1-15	2	1	1	-
		16-35	3	1	2	-
	Female	1-12	-	-	-	1
		13-25	-	-	-	2

4.11.11.4. STORAGE CONSTRUCTION AND PIPING MATERIALS OF WATER-BORNE SANITATION

4.11.11.4.1. The materials used for piping in water-borne sanitation shall conform to the quality requirements materials of ISO 3633 and where expected a compaction, they shall be insulated adequately so that they don't cause any danger.

4.11.11.4.2. The contents of a chemical toilet shall be disposed of in accordance with the directives of the Minister responsible for Health.

4.11.11.4.3. SEPTIC TANK REQUIREMENTS

4.11.11.4.3.1. Any septic tank shall, where an evapotranspirative bed is installed instead of a french drain with the approval of the Building consent Authority:

(i) Be designed with a capacity of not less than 1.7 m^3 and be capable of receiving one day's sewage flow as given in Table 4.11.11-2 where it is to serve a dwelling unit.

(ii) Be of a designed capacity not less than 3 times the daily flow from such building, using the per capita sewage flow given in Table 4.11.11-2 or such other flow as may be determined by the authority where not so given, where it is to serve any building not being a dwelling unit,;

(iii) Be so constructed that:

a. It is provided with a means of access for the purpose of emptying and cleaning; and
b. The depth in such tank below the outlet invert is not less
c. Than 1m and there is an airspace of not less than 200mm between the surface of the liquid contained therein and the underside of the top cover of such tank.

4.11.11.4.3.2. No industrial effluent shall be allowed to flow into any septic tank.

4.11.11.4.3.3. The designer of septic tank in which water-borne are directed shall ensure that it will operate sufficiently at an adequate temperature, protected against any damage and shall be in accordance with ministry of health regulations.

4.11.11.4.3.4. A building owner who constructs a septic tank or related installation shall do what is possible to afford means of access to the septic tank for the purpose of cleaning or removal of the contents of the septic tank, residue, or sludge. He/she shall cause the septic tank and subsurface installation or any works with respect to the treatment and disposal of sewage to be sufficiently covered, ventilated or protected to prevent any nuisance from the septic tank or the possible breeding of mosquitoes in the septic tank.

4.11.11.4.3.5. Water-borne shall be constructed where practicable in a manner by which the heat generated by these waste shall be retained inside by insulation. It shall be designed in accordance with building classifications and its capacity shall be sufficiently adequate for the building occupancy's number in order to prevent the storage overflow.

4.11.11.4.3.6. A septic tank or other works for the treatment, reception or disposal of sewage shall not be constructed except by permission of the Authority and shall be deemed to satisfy the requirement of Part 6, Section 3 of this code concerning the excavation.

4.11.11.4.3.7. A septic tank or other installations for the disposal of sewage shall not be constructed under any building, within 3m of any building or plot boundary, or within 50m of any well, spring, stream or water used or likely to be used for drinking, domestic purposes, or in the manufacture of drinks, or in any such position as to cause pollution of water.

4.11.11.4.3.8. Wastewater from water-flushed toilets may be discharged either locally to a leach pit, a septic tank and soak away, or to a sewer or drain which carries it away from the plot and no drain, surface channel, or any other means of conveying rainwater or surface water shall discharge into a septic tank designed for water-borne disposal.

4.11.11.4.3.9. The walls, floor, and roof of any septic tank, conservancy tank, or effluent tank for the reception of water-borne, shall be constructed of impervious materials or shall be rendered impervious by waterproofing with approved materials and methods.

4.11.11.4.3.10. Wastewater treatment systems, design and construction of septic and other associated effluent disposal system shall comply with RS 143.

Table 4.11.11-2: Sewage Flow from Buildings

Type of Establishment	Sewage Flow (l / person / day)
Boarding houses (Additional kitchen wastes for non-resident boarders)	110
Hotels without private baths	23
Hotels with private baths	110
Restaurants (toilet & kitchen wastes per patron)	140
Tourist camps or caravan parks with central	20
Bathhouse	90
Day schools	37
Day workers at offices per shift	90
Hospitals	500
Factories (litres per person per shift, exclusive of industrial wastes)	140
Swimming baths	9

Motels (per bed)	90
Drive-in theatres (per car space)	9
Residential dwelling units	150

Table 4.11.11-3: Rates of Percolation and Effluent Application

Percolation rate: Average time for 25mm fall of test water level, (min)	**Rate of application of effluent to subsoil infiltration areas, l/m^2 of french drain wall area per day**
0-3	108 max
3-5	108-100
6-10	99-80
11-15	79-65
16-20	64-53
21-26	52-40
27-30	39-33
Over 30	Not permitted

4.11.11.4.4. CONSERVANCY TANK

4.11.11.4.4.1. Any conservancy tank shall:

(i) Have a capacity as prescribed by the Building Consent Authority.;

(ii) Be constructed with means of access for cleaning;

(iii) Be provided with a means for clearing as prescribed by the Building Consent Authority.

4.11.11.4.4.2. Any conservancy tank to be used on a site for the reception of sewage shall:

(i) Be so designed and constructed that it will be impervious to liquid;

(ii) Be so sited:

a. That there will be a ready means of access for the clearing of such tank;

b. As not to endanger the structure of any building or any services on the site; and

c. Be so designed and sited that it is not likely to become a source of nuisance or a danger to health.

4.11.11.5. CONTROL AND PROHIBITION OF WATER-BORNE DISPOSAL

4.11.11.5.1. Domestic wastewater which are firstly stored in a septic tank and flushed in nature shall be treated so that to meet the requirements of RS 110 in order to prevent any nuisance that should be caused by such water.

4.11.11.5.2. Temporary drainage channels or perimeter dike/swale shall be constructed to carry the pollutant-laden water directly to treatment device or facility.

4.11.11.5.3. The plan of water borne disposal facility shall indicate how the above is accomplished on site, well in advance of the commencing of the construction activity.

4.11.11.5.4. Any french drain which is to receive effluent or any evapotranspirative bed shall:

(i) be so constructed and located as not to cause the pollution of any spring, stream, well or other source of water which is used or is likely to be used for drinking, domestic or kitchen purposes;

(ii) have a capacity, be so constructed and contain suitable material so as to adequately receive and dispose of any effluent flowing into it; and

(iii) be not less than 3m from any building or boundary of the site on which it is situated.

(i) The ground in which it is proposed to construct a french drain shall be tested for percolation in accordance with the method contained in Part 6 Section 3 of this Code.

4.11.11.5.5. Suitable design modifications for sedimentation, chemical and biological processes shall be applied to sewage treatment plants for satisfactory functioning and avoid any harm.

4.11.11.5.6. Industrial wastewater shall be treated before being evacuated in nature to meet the specifications of RS 109 and shall be tested in accordance with the said standard to determine the tolerance limit so that they don't cause any danger for person life and for the whole environment in general.

4.11.11.5.7. Wastewater from any kitchen, washer room shall be treated and discharged into a separate soakage pit or other sub surface seepage methods to facilitate water-borne treatment.

4.11.11.5.8. No building or institution relatively to its occupancy shall cause or permit a discharge of the water-borne from any sanitary fixture either in any storm-water drain, storm-water sewer or excavated or constructed watercourse; any river, stream or natural watercourse whether ordinarily dry or otherwise; or any street or other site.

4.11.11.5.9. No dwelling or any building occupied for any purpose shall, without the written permission of the Authority, discharge or cause the discharge of any water from a swimming pool, fountain or reservoir, car washing, butchery, abattoir, cowshed or any location which produces wastewater either directly or indirectly, onto any public street or public place.

4.11.11.5.10. In case wastewater is to be flushed in nature, it shall be treated and tested before in accordance with RS ISO 6332, RS ISO 10523, RS ISO 6222 and other suitable standard for determining if the water to be flushed is of no harm to any organism and to the whole environment.

4.11.11.6. FLUSH WATER TOILET FOR PEOPLE WITH DISABILITY

4.11.11.6.1. Facilities for persons with disabilities shall be included in the design and construction of any public building, hotel, dormitory or any other building where a group of persons are accommodated mainly for sanitary purpose.

4.11.11.6.2. Suitable toilet facilities and bathroom shall be purpose-designed and constructed for persons with disabilities, shall be provided in the building and shall be accessible to disabled persons without requiring assistance.

4.11.11.6.3. The number of toilets or sanitary facilities that must be provided for persons with disabilities in wheelchairs shall be determined in accordance with the Table 4.11.11-4, and for any building that will be used as a hotel, lodging or hostel, not less than one guest room for every 100 guest rooms shall be designed, constructed or adapted for use by persons with disabilities.

Table 4.11.11-4 Toilets & Washbasins for Persons with Disabilities on Wheelchairs

Number of Persons	Number of Sanitary Units
Up to 10	0
10-50	1
Over 50	2

4.11.11.7. SEWAGE TREATMENT PLANT

4.11.11.7.1. No person shall install or construct any sewage treatment plant without obtaining the previous sanction of the Authority.

4.11.11.7.2. The owner shall make an application to the Building Consent Authority to carry out such a work.

4.11.11.7.3. The location of the waste water treatment plant for different occupancies shall be selected in accordance with the requirements of the Building Consent Authority of the city.

4.11.11.7.4. The building in building occupancy class B-1 shall be provided with a waste water treatment plant to treat sewage before it is drained in the environment.

4.11.11.7.5. For construction and environmental purposes, the waste water treatment plants shall be in accordance with relevant parts of RS 126 and with the requirements of the local Authority.

4.11.11.7.6. For solid waste from the hospitals where incineration method is used, their plants for destruction of waste shall comply with the specification of RS EAS 491 and RS EAS 492.

4.11.11.7.7. The waste within healthcare facilities shall be handled and disposed in accordance with RS 209.

4.11.11.7.8. The safety procedures for disposal of surplus pesticides and associated toxic waste shall be in accordance with RS 210.

SECTION 12: NON -WATER BORNE SANITATION

4.11.12.1. GENERAL REQUIREMENTS

4.11.12.1.1. All other sanitary facilities shall be permitted where water-borne sewage disposal is not available provided that in the case of chemical or pail closets, a satisfactory means shall be available for the removal and disposal of sewage from such closets.

4.11.12.1.2. Where water flushing methods are not used as sanitary methods, the materials such as ash, green clothe shall be allowed to be used as sanitary facilities in order to absorb few water available and prevent some diseases caused.

4.11.12.1.3. VIP latrines shall be used as sanitary facility where the water supply is not sufficient or not available to satisfy the population provisions. It shall be ventilated in directly to external air where dwelling occupants are more than 20 persons relatively to the building occupancy and referring to the specifications of the Table 4.11.11 -1 provided for in Part 11, Section 11 of this Code.

4.11.12.1.4. The latrines which don't require water flushing, shall be sited at reasonable distance between 1.5m and 3m from habitation dwelling and readily accessible, it shall be emptied at time whenever contents are within a half-meter of the cover slab in order to prevent nuisance that should be caused by them.

4.11.12.1.5. In case the service of emptying the ventilated improved pit latrines is not available in that place, the ventilated improved pit within a half-meter to the cover slab shall be closed and replaced by a new one. The new ventilated improved pit superstructure shall be constructed by approved strong and durable materials to offer adequate privacy, comfort and safety while the latrine is being used.

4.11.12.1.6. The construction of the superstructure of latrines shall conform to the provisions provided in Part 6 of this code for masonry construction and the slab cover shall comply with requirements specified in Part 6 of this Code.

4.11.12.1.7. The latrine superstructure shall be provided with an opening, or openings, of area at least $0.2m^2$ for the purposes of natural lighting and through-ventilation. The inside of the latrine, however, shall be adequately dark to discourage flies from entering.

4.11.12.1.8. Prior the excavation of the pit latrine, the owner shall obtain the permission to the Authority to execute that tusk, that excavation shall be sited within 3m of any building or any boundary of the site on which it is located.

4.11.12.1.9. The region where the water table is at a few meter of depth, the latrines excavation shall not go far so that the fecal material don't contaminate the water. Two pit latrines with a reasonable depth shall be used alternatively in these region and emptying one while using another.

4.11.12.1.10. All non-chemical closets which forms part of any dwelling house shall be oriented and sited in a manner so as to avoid the foul odors to reach the rest of the house and shall conform to the provisions provided in regulation 4.11.12.3.

4.11.12.2. LIGHTING AND VENTILATION FOR NON-WATERBORNE TOILET

4.11.12.2.1. All sanitary facilities which don't require water flushing shall be aerated by either natural ventilation or artificial ventilation in order to provide suitable and adequate usefulness of these sanitary facilities

4.11.12.2.2. For ventilated improved pit latrines, the vent pipe which ventilates the whole pit shall be not less than 100mm in diameter, made with either by a coated or lined galvanized metal or cast iron or masonry concrete unplasticized poly (vinyl chloride) or fibre glass or any other approved durable and not easily to be corroded materials and shall be opened directly from the pit in order to control odor and flies from the latrine.

4.11.12.2.3. All ventilation pipes shall be screened with a non-corrosive material which is resistant to ultraviolet radiation to prevent insects from entering or from escaping from substructures. The apertures in the mesh of screens over the ventilation pipes shall be small enough to trap insects, but large enough to achieve proper ventilation of the substructure. The construction shall be such that it is not possible for leaves and other debris to accumulate on top of the screen.

4.11.12.2.4. A ventilation pipe shall be fitted with a fly screen with apertures not larger than 1.5mm square and coated with corrosion resistant material which is capable of withstanding rain, heat or direct sunlight.

4.11.12.3. CLOSETS AND LATRINES

4.11.12.3.1. All closets shall be erected in conformity to the provisions provided in Part 6, Sections 5 and 7 of this Code for walls and roofs. It shall be provided with a door or other means which shall ensure privacy of the occupants of such a closet.

4.11.12.3.2. All closets shall be deemed to satisfy the provisions of sub-regulation 4.11.12.3 and they will be provided with an opening of area not less than $0.2m^2$ which will give natural lighting and ventilation.

4.11.12.3.3. A closet shall be provided with a seat and a receptacle of such height that a space of not more than 25mm is left between the underside of such seat and the top of the receptacle; and the aperture in such seat shall be at least 25mm less in every diameter than the corresponding diameter of the top of such receptacle and such aperture shall be fitted with a self-closing, fly-proof lid.

4.11.12.3.4. All excavation for a pit latrine shall comply with the provisions provided in Part 6,Section 3 of this Code, and when they are positioned outside of the closet so that excreta are delivered into it from a chute fitted under the closet seat, such excavation shall be adequately covered.

4.11.12.3.5. Where female and male persons are both employed or housed, including a school or college there shall be provided separate latrine facilities, the entrances to which shall be effectively screened off and marked with "Women only" or "Men Only" signs, by or with internationally recognized symbols.

4.11.12.3.6. Any closet which contains a removable pail shall be provided with access to such pail for replacement purposes so that the pail is not carried out through the doorway of such closet.

4.11.12.4. VENTILATED IMPROVED PIT LATRINE

4.11.12.4.1. Ventilated Improved Pit latrines shall be constructed with approved durable materials in conformity with sub-article 4.11.12.3 the interior finishes shall be adequate and smooth to provide a suitable hygiene and the whole superstructure shall not be less than 2.1m in height, 800mm in width and 1.2m in length.

4.11.12.4.2. Ventilated Improved Pit latrines shall only be constructed where the percolation rate does not exceed 50mm/h and shall not penetrate the water table and not be built under or near trees.

4.11.12.4.3. Ventilated Improved Pit latrines shall only be situated downstream at a distance not less than 30m away from a well or water source; and shall be located at least 5m away from buildings.

4.11.12.4.4. VIP latrines, which have permanent structures constructed over the pits, shall have fully lined pits, shall be capable of being emptied and shall have a capacity such that the cleaning interval is not less than a year.

4.11.12.4.5. VIP latrines shall be provided with a seat and closing lid such that the space between the underside of the seat and the top of the receptacle is not more than 25mm. The seat shall be so designed that the aperture at the top of th seat is not less than 250mm and not more than 300mm in diameter. For children, an additional seat that has an aperture of between 150mm and 200mm may be provided.

4.11.12.4.6. Measures shall be taken to prevent rainwater, soil, rubbish and other foreign material from entering the system. Separate provisions shall be made for the disposal of grey-water and other household waste as specified in Part 11, Section 11of this Code.

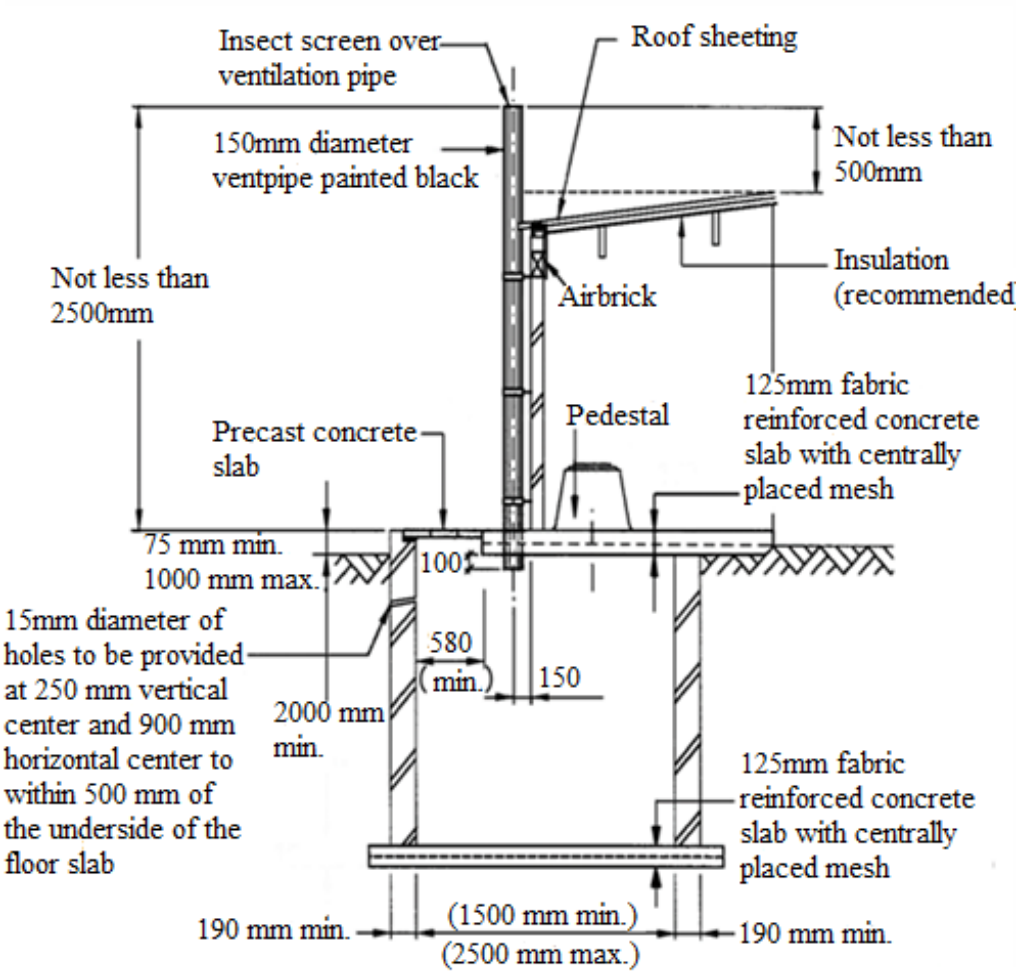

Figure 4.11.12-1 VIP Latrine Details

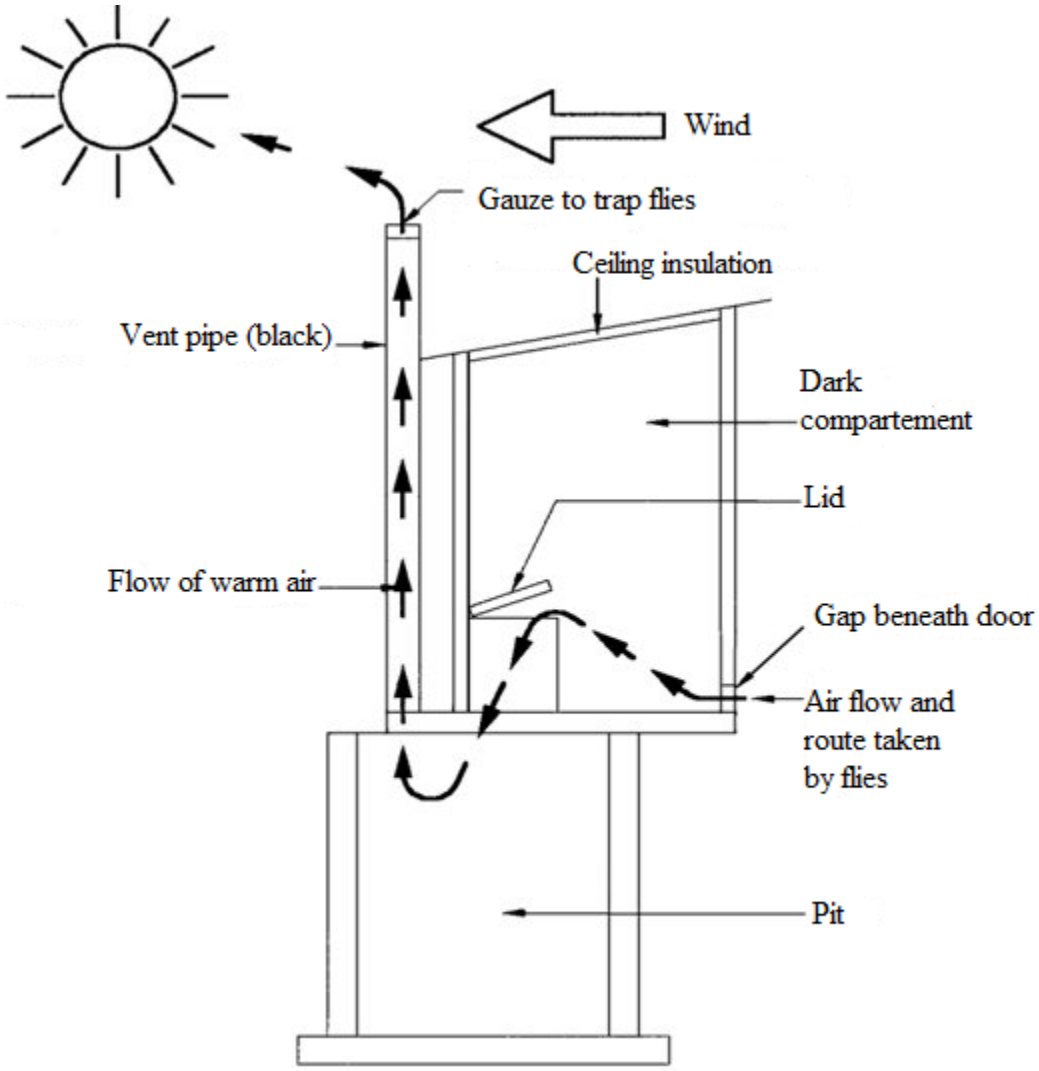

Figure 4.11.12-2 The Concept behind Ventilated Improve Pit latrines

4.11.12.5. ECOSAN (ECOLOGICAL SANITATION) TOILETS

4.11.12.5.1. COMPOST TOILETS

4.11.12.5.1.1. Composting toilets shall be used as an alternative to flush water toilets in situations where no suitable water supply is available so as to facilitate environmental management.

4.11.12.5.2. TWO PIT COMPOST TOILET

4.11.12.5.2.1. Two pit compost toilets shall be provided as an alternative sanitary facility to contribute to water management and facilitate the waste management.

4.11.12.5.3. URINE DIVERTING TO DRY TOILETS

4.11.12.5.3.1. Dry toilets shall not use pits; they shall be built above ground to make easy the removal of the contents. They shall also have a toilet bowl with separate compartments to keep urine and feces separate.

4.11.12.5.3.2. Dry toilets shall be used where:

(i) The groundwater is too high for pit toilets;
(ii) Flooding is common;
(iii) The ground is too hard to dig; and
(iv) People want a permanent toilet in or near their house.

4.11.12.5.3.3. Ecological toilets shall be used only for human waste. Women having monthly bleeding shall safely use ecological toilets. But sanitary pads and other products shall not be put in the toilet.

4.11.12.5.3.4. Ecological toilets shall not be used to dispose of things that will not break down, such as Cans, bottles, plastic, tampons, or large amounts of paper. There shall be used small amounts of paper, leaves, sawdust, and other plant matter because these things break down into soil.

4.11.12.5.4. POUR FLUSH PIT TOILETS

4.11.12.5.4.1. Pour flush toilets shall have 2 pits and a junction box that directs waste towards the pit in use. The first pit shall be used until nearly full. Then waste shall be diverted into the second pit

4.11.12.5.4.2. Depending on soil conditions and groundwater level, pour flush toilets shall never be built less than 3m from wells.

4.11.12.6. NON-WATER TOILET FOR PEOPLE WITH DISABILITIES

4.11.12.6.1. All latrines pit toilet facility shall be purpose-designed and constructed for ease use of children, adults and persons with disabilities. The Figure below illustrates a toilets adapted for wheelchairs.

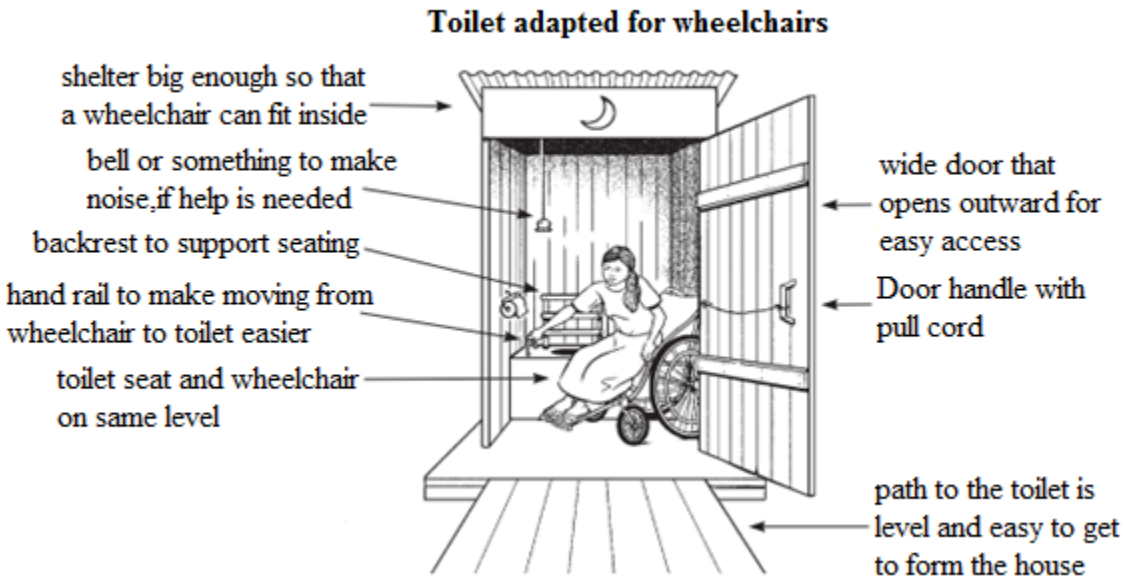

Figure 4.11.12-3 Pit Latrine Details - Section through Pit

4.11.12.6.2. Pit latrines mainly ECOSAN latrines located on street wayside, rest areas, campgrounds, picnic grounds, parks, trailer parks, and mobile home parks shall be provided accessibility for people with disabilities and within the toilet shall conform to sub-article 4.11.12.6.1 as well as permanent bath and shower facilities.

SECTION 13: SOLID WASTE MANAGEMENT

4.11.13.1. GENERAL REQUIREMENTS

4.11.13.1.1. The owner or tenant of any premises, business establishment or industry shall be responsible for the satisfactory removal of all refuse accumulated on the property or premises in accordance with RS 180.

4.11.13.1.2. The garbage shall not be allowed to remain on the premises for a long time to prevent propagation, attraction of flies, rodents, or other vectors, and the creation of nuisances. Where it is deemed necessary by the health officer because of the propagation of vectors and for the protection of public health, more frequent removal of garbage may be required.

4.11.13.1.3. If the owner of the building operations fails to comply with the notice, he or she is considered to have committed an offence and is liable on conviction to a fine in accordance with laws in force in Rwanda.

4.11.13.1.4. Each person providing residential, commercial or industrial solid waste collection services shall comply with the Authority license, permits or written approval and shall adhere to the code of practice RS 180, RS 182 and RS 181.

4.11.13.1.5. The Authority may, at the cost of the owner, remove the rubble, rubbish, other debris or combustible waste material from the site, if the owner fails to comply with the notice served under sub-regulation 4.11.13.1.1 above.

4.11.13.1.6. Any person erecting or demolishing a building shall remove surplus material and matter arising from the erection or demolition of the site or from any other land, public street or public place affected by the material during or after the completion of the erection or demolition.

4.11.13.1.7. The design of any new, remodelled or expanded building or complex of buildings shall make provision for adequate storage and handling facilities for solid wastes and public health hazardous wastes. The design shall clearly take into consideration the efficient and safe waste removal or collection. The design shall demonstrate that it includes the required provisions for storage capabilities and access to waste containers in accordance with RS 180, RS 182 and RS 181.

4.11.13.2. SOLID WASTE COLLECTION

4.11.13.2.1. Before storage and handling of the solid waste, the following objects need to be removed: Inert matters like glass, metals, etc, Chemicals, medicines, batteries of any kind; Polythene and plastic materials; and any other non-biodegradable material.

4.11.13.2.2. These separated items shall be handled separately, and may be scrapped, recycled or otherwise as appropriate.

4.11.13.3. SOLID WASTE STORAGE

4.11.13.3.1. Appropriate means to collect solid waste shall be required for each household to facilitate their managements.

4.11.13.3.2. The owner, operator and/or occupant of any premises, business establishment, industry or other property, vacant or occupied, shall be responsible for the safe and sanitary storage of all solid waste accumulated on the property and shall provide adequate on-site storage space for the number of waste storage required.

4.11.13.3.3. The containers for each household shall be functional to the type of materials and the collection vehicles used.

4.11.13.3.4. Containers shall also be durable, easy to handle, economical as well as resistant to corrosion, weather conditions, and metals, glass tips in accordance with RS 180, RS 182 and RS 181.

4.11.13.4. SOLID WASTE DISPOSAL

4.11.13.4.1. All wastes whether they are residential, commercial or from any other sources shall be collected and transported to the disposal site in accordance with RS 180, RS 182 and RS 181.

4.11.13.4.2. All solid waste shall be disposed of outside the City in approved disposal facilities except where special arrangements have been made for other disposal methods with the approval of the Authority.

4.11.13.4.3. Sanitary landfills and health centers shall be erected to greatly reduce or eliminate the risks that waste disposal may pose to the public health and environmental quality and also shall comply with RS 209.

4.11.13.4.4. Landfills are not homogenous and are usually made up of cells in which a known volume of waste is kept isolated from adjacent waste cells by a suitable barrier.

4.11.13.4.5. The feasibility of solid waste disposal shall depend on the factors such as type, quality, quantity and characteristics of wastes, legal aspects, and soil and site characteristics.

4.11.13.5. WASTE MATERIAL ON SITE

4.11.13.5.1. Where in the opinion of the approving Authority excessive rubble, rubbish, other debris or combustible waste material is allowed to accumulate on a site before or during building operations, it may, by written notice, order the owner of such site to have such rubble, rubbish, other debris or combustible waste material removed within the period specified in such notice.

4.11.13.5.2. In all cases in which garbage and rubbish are combined, the standards for garbage shall prevail. The property owner or occupant shall store solid waste on his premises or property, or shall require it to be stored or handled, in such a manner so as not to promote the propagation, attraction of vectors, or the creation of nuisances.

4.11.13.5.3. Any owner who fails to comply with such notice shall be guilty of an offence and the approving Authority may remove the said rubble, rubbish, other debris or combustible waste material from such site and may recover the costs of such removal from the owner.

4.11.13.6. SOLID WASTE MANAGEMENT SYSTEMS

4.11.13.6.1. REFUSE CHUTE SYSTEM

4.11.13.6.1.1. Refuse chute system is an appropriate and safe mode of assortment of domestic solid wastes from buildings exceeding 3 floors.

4.11.13.6.1.2. The inner diameter of the chute shall be at least 300mm.

4.11.13.6.1.3. The entrance to the refuse chute shall be supply from well ventilated and well illuminated common corridor or lobby and preferably it should not be located opposite or adjacent to entry of individual flats or lift.

4.11.13.6.1.4. Opening, with top or bottom hinged shutters with appropriate lockable handle, shall be provided for convenient accessing of the refuse chute by users.

4.11.13.6.1.5. The chute may be of building materials or suitable non-corrosive material. Further the material should be rigid with smooth internal finish, high ductility and acid resistant properties and it shall be constructed so that it affords protection against any element, weather, scavengers and other vermin, and shall be capable of being maintained in hygienic condition so it is not permitted to dispose refuse on public land, streets or sidewalks.

4.11.13.6.1.6. The collection chamber may be positioned in ground floor or basement level, on condition that appropriate arrangement is made for drainage of the collection pit by gravity flow to ensure its dryness; an appropriate ramp access is provided for convenient removal of garbage from the collection pit, and satisfactory ventilation for escape of gas and smells.

4.11.13.6.2. COMPOSTING

4.11.13.6.2.1. Vermi-compost treatment shall be provided to the organic wastes in comporting pits located in shade (dark) and shall be easily accessed for convenient shifting of garbage from trolleys carrying garbage.

4.11.13.6.2.2. The site for vermi-comporting shall be enclosed from all sides with appropriate barrier (for keeping scavenging animals away) and provided with a small door for accessing the surrounded sites.

4.11.13.6.2.3. The composting pits shall be made in a manner that the pits do not have the risk of inundation by water. This may be achieved by appropriately raising the base level of the pit and providing weep holes from sides.

4.11.13.6.2.4. The compost may be removed from the bottom of the compost pit after intervals of 3 to 6 months.

4.11.13.6.3. INCINERATION

4.11.13.6.3.1. Incineration of solid waste shall be done for mainly contaminating wastes and shall be used as the best manner of solid waste management. Incinerators shall be designed in way of to promote both solid waste management and environmental safety.

4.11.13.6.3.2. Hazardous wastes are those produced in the industries, institutes, hospitals and laboratories. These are dangerous to the living organisms immediately or in the long run to the environment in which they are disposed. So, they shall be burned by incineration in accordance with RS EAS 493, RS EAS 491, RS EAS 492 and RS EAS 494.

4.11.13.6.4. RECYCLING

4.11.13.6.4.1. The non-biodegradable materials like paper, plastics, metals, glass and wood shall be collected and recycled in accordance with RS ISO 15270.

4.11.13.6.4.2. Medical wastes which contain highly infectious organisms, sharp objects, hazardous pharmaceuticals, chemicals, radioactive materials and other various forms of health center waste shall be treated at the source.

4.11.13.6.4.3. General waste shall be segregated from hazardous material and other infectious waste and shall be treated in manner which ensures both management and environmental safety.

4.11.13.7. PUBLIC HEALTH AND ENVIRONMENTAL HYGIENE

4.11.13.7.1. Where a rubbish chute is provided, it shall be located and constructed to convey the solid waste to an appropriate storage container, avoid the possibility of blockage or leakage, Permit easy cleaning and maintenance, avoid the possibility of foul air or gases accumulating or entering the building, avoid the possibility of the spread of fire beyond the refuse chute, have openings that allow waste to be safely deposited in the chute and restrict access by children, animals and vermin.

4.11.13.7.2. It shall be unlawful to connect water piping supplied directly from city water mains or other approved sources or to piping from underground storage tanks or other unapproved sources.

4.11.13.7.3. Cross connection shall not be made between the portable water distribution system and any portion of waste or soil systems, or fixtures or devices that will contaminate, pollute or otherwise render the water unsafe.

4.11.13.7.4. All waste materials shall be removed in a manner which prevents injury or damage to people, adjoining properties and public rights of way and keep such premises in safe and sanitary condition accordance with RS 210.

4.11.13.7.5. Material shall not be dropped by gravity or thrown outside the exterior walls of a building during demolition or erection.

4.11.13.7.6. Wood or metal chutes shall be provided for this purpose and any material which in its removal will cause an excessive amount of dust shall be wet down to prevent the creation of a nuisance.

4.11.13.8. PERFORMANCE

4.11.13.8.1. Where facility is made within buildings for the collection and temporary holding of solid waste, the spaces provided shall be of sufficient size for the volume of waste and frequency of disposal, provided with reasonable access for the depositing and collection of the waste and capable of maintaining sanitary conditions having regard to the types of waste and storage containers.

REPUBLIC OF RWANDA

CHAPTER 5:

CONSTRUCTION SAFETY,INSPECTION,MAINTENANCE & DISASTER RISK MANAGEMENT

RWANDA BUILDING CODE

Chapter Five:
CONSTRUCTION SAFETY, INSPECTION, MAINTENANCE & DISASTER RISK MANAGEMENT

PART 12: SAFEGUARDS DURING CONSTRUCTION

PART 13: EXISTING STRUCTURES

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RWANDA BUILDING CODE

Chapter Five:
CONSTRUCTION SAFETY, INSPECTION, MAINTENANCE & DISASTER RISK MANAGEMENT

PART 12:

SAFEGUARDS DURING CONSTRUCTION

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PART 12: SAFEGUARDS DURING CONSTRUCTION

SECTION 1: CONSTRUCTION SAFEGUARDS

5.12.1.1. GENERAL REQUIREMENTS

5.12.1.1.1. All construction projects shall comply with the requirements of RS ISO 45001 in the management of health and safety, identify risks and reduce hazards during construction

5.12.1.1.2. Construction equipment and materials shall be stored and well placed so as not to endanger the public, the workers and adjacent property for the duration of the construction project.

5.12.1.1.3. All the construction materials shall be stored in such a way that there may not be any possibility of fire hazards. Inflammable materials like kerosene and petrol shall be stored in accordance with the relevant rules and regulations so as to ensure the desired safety during storage. Stacks shall not be piled so high as to make them unstable under fire fighting conditions and in general they shall not be more than 4.5m in height.

5.12.1.1.4. Materials which are likely to be affected by corrosion like steel or subsidence of soil like precast beams, slabs and timber shall be stored by adopting suitable measures to ensure unyielding supports.

5.12.1.1.5. Materials liable to be affected by hazards including floods and tides shall be suitably stored to prevent their being washed away or damaged due to floods or tides.

5.12.1.1.6. A fire protection procedure is to be set up in accordance with Part 12 Section 6 of this Code if there is to be any flame cutting, burning, heating, riveting or any operation that could start a fire. Measures of precautions shall be taken during welding and cutting operations.

5.12.1.1.7. The workers shall be instructed not to throw around objects like hot rivets, cigarette stubs, and other object which can start fire.

5.12.1.1.8. Every place of work shall be made and kept safe, and without risks to any person's health at work.

5.12.1.1.9. Every place of work shall have sufficient working space and be so arranged that it is suitable for any person who is working or who is likely to work there, taking into account of any necessary work equipment present.

5.12.1.1.10. Every part of construction site shall be kept in good order and every part of construction site used as a place of work shall be kept in reasonable state of cleanliness.

5.12.1.1.11. Required exits, existing structural elements, fire protection devices and other safeguards facilities shall be maintained at all times during remodeling, alterations, repairs or additions to any building or structure.

5.12.1.1.12. Waste materials shall be removed so as to prevent injury or damage to persons, adjoining properties and public rights-of-way.

5.12.1.1.13. Materials which are likely to cause dust nuisance or undue environmental pollution in any other way, shall be removed from the site at the earliest and till then they shall be suitable covered. Such materials shall be covered during transportation and the contractor shall insure cleanness of the surrounding.

5.12.1.1.14. The work of removal of debris should be carried out during day. In case of poor visibility artificial light may be provided.

5.12.1.1.15. At every construction site, the contractor shall designate a person in charge of site records and safety of the workers. That person shall be accountable of the safety and health of the workers and the general welfare of the construction site.

5.12.1.1.16. The contractor shall ensure that all workers on the construction site receive prior and periodic basic trainings about health and safety, specific safety guidelines, and hazardous materials, areas and procedures associated with the construction.

5.12.1.2. PROTECTIVE CLOTHING AND EQUIPMENTS

5.12.1.2.1. Head, hand and foot protection appropriate to the type of exposure shall be worn by workers on all construction sites. The suitable protective gears include safety helmets, boots, hand gloves, goggles and special attire.

5.12.1.2.2. If work is performed in places in the vicinity of traffic, the worker shall wear a bright waistcoat or clothing. In the dark the bright clothing must be provided with reflecting bands.

5.12.1.2.3. If work is performed in the dark or underground, a reflex reflector band shall be worn on clothing.

5.12.1.2.4. In the construction site the contractor shall ensure safety footwear and water proof shoes for workers working in muddy areas and concrete.

5.12.1.2.5. A protective helmet is mandatory for every person frequenting the building construction site.

5.12.1.2.6. Safety belts equipped with safety ropes shall be used while working on scaffolding, roofs and work platforms and in other places where falling from a height cannot be prevented by other safety measures.

5.12.1.2.7. On the construction site, the contractor shall ensure that every worker has the appropriate personal protective clothing/equipment amongst the following:

(i) Protective breathing equipment for workers at work where dust may be produced from the activities;

(ii) Goggles, for workers where rays may be produced from the activities;

(iii) Foot wears of an appropriate type for workers exposed to injury from hot, corrosive or poisonous substances;

(iv) Safety belts where it is not practicable to provide safe working platform;

(v) Suitable gloves for workers exposed to hot, corrosive or toxic substances or hand or arm injuries rough point edges or surface of objects; and

(vi) Ear protectors where it is not practicable to reduce noise exposure to levels below those prescribed in Part 11 Section 5 of this Code.

5.12.1.2.8. The contractor shall provide the first aid box and this shall be placed at the most accessible location. Every person at work on the construction site shall be instructed on the proper use of the first aid box.

5.12.1.3. WALKWAYS

5.12.1.3.1. A walkway shall be provided for pedestrians travelling in front of every construction and demolition site. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but in no case shall they be less than 1.2m in width. Walkways shall be provided with a durable walking surface.

5.12.1.3.2. Walkways shall be protected from falling objects. Where applicable, walkthrough containers shall be adopted specially to provide passageway near tall buildings.

5.12.1.4. EXCAVATION

5.12.1.4.1. Excavation for buildings and structures shall be constructed or protected (including all provisions for supports or battering) so as not to endanger life or property. All suitable and sufficient cautions shall be taken when carrying out the work to prevent danger to any person or property.

5.12.1.4.2. Where excavation may impair the safety or stability of any property, the contractor/owner of the site shall take adequate precautionary measures to ensure that the safety and stability of all concerned properties by that work is maintained.

5.12.1.4.3. Where gases or fumes are likely to be present in trenches, sufficient mechanical ventilation, to protect the health and safety of persons working at the site, shall be provided.

5.12.1.4.4. Where excavation is going on, for the safety of public and the workmen, fencing shall be erected, if there is likelihood of the public frequenting the area. Sufficient number of notice boards and danger sign lights shall be provided in the area to avoid any member of public from inadvertently falling into the excavation.

5.12.1.4.5. Heavy and light equipment such as excavating machinery and road traffic shall be kept back from the excavated sites at a distance of not less than the depth of trench or at least 6m for trenches deeper than 6m.

5.12.1.4.6. Care shall be taken to keep excavating tools and materials far away from the edge of trench to prevent such items being inadvertently knocked into the trench.

5.12.1.4.7. Excavated materials shall be kept back from the edges of the trench to provide clear berm of safe width. Where this is not feasible, the protective works designed for the trenches shall take into consideration, the additional load due to overburden of materials.

5.12.1.4.8. Wood forms which have been used in placing concrete, if within the ground or between foundation sills and the ground, shall be removed before a building is occupied or used for any purpose.

5.12.1.5. SCAFFOLD

5.12.1.5.1. Scaffolds shall be erected by experienced workers under the supervision of a competent professional. Any alteration shall not be made to them unless authorized by the competent person.

5.12.1.5.2. Scaffolds shall be inspected by the Authority for the safety, during different stages of inspection outlined in Part 14 Section 1 of this Code.

5.12.1.5.3. Scaffolds shall fulfil the requirements of RS 263-1 and their components shall be capable of supporting without failure at least four times the maximum intended load.

5.12.1.5.4. All scaffolding exceeding 26m or seven floors in height used in construction operations involving the erection, alteration or maintenance of buildings, shall be constructed of non-combustible or fire-retardant materials complying with the provision of Part 7 Section 2 of this Code.

5.12.1.5.5. Scaffold must be structurally sound and regularly inspected for required application and must have toe boards, handrails , fall restraints and safe access stairs or ladders.

5.12.1.6. FENCING

Where construction is going on, for the safety of public and the workers, fencing shall be erected, especially if there is a possibility of the public or animals to frequent the vicinity of the construction site. Sufficient number of notice boards and danger signs shall be provided in the area to avoid any member of public from inadvertently entering into the site.

5.12.1.7. LADDERS

5.12.1.7.1. Every ladder used shall be of good construction, sound material and adequate strength.

5.12.1.7.2. Ladders shall not stand on loose stones or other loosely parked materials but shall have a firm basis.

5.12.1.7.3. The upper and lower ends of the ladders shall be securely fixed.

5.12.1.7.4. Metal ladders shall not be used around the non-isolated electrical circuits like power supply system where there is a possibility of coming in contact with the current.

5.12.1.8. ELECTRICITY

5.12.1.8.1. Every electrical installation connected to an external electrical supply system, shall contain safeguards which protect the safety features of the external supply.

5.12.1.8.2. No scaffolding, ladder, working platform or gangway runs shall exist within 3m of any un-insulated electric circuit like power supply system.

SECTION 2: DEMOLITIONS

5.12.2.1. PRELIMINARY CONSIDERATIONS

5.12.2.1.1. Before a building is demolished, the owner or the contractor shall notify all utilities having service connections within the building, such as water, electric, sewer and other connections.

5.12.2.1.2. Before beginning the actual work of demolition, a careful study of the structure due to demolition and of all its surroundings shall be made. This includes the study of the manner in which various parts of the building to be demolished are supported and assembled and the impact that the demolition shall have on the environment.

5.12.2.1.3. A defined plan of procedure for the demolition work, depending upon the manner in which the loads of the various structural parts are supported shall be prepared by a qualified professional and approved by the Authority's personnel in charge of demolition and this shall be followed as closely as possible.

5.12.2.1.4. It should be ensured that the demolition operations do not endanger the safety of the adjoining buildings at any stage. In addition, the nuisance effect of the demolishing work on the use of the adjacent buildings should be kept to the minimum.

5.12.2.1.5. In addition, the above provisions in this code, construction demolition and waste management shall be done in accordance with the requirements of RS 367.

5.12.2.2. REQUIREMENTS FOR DEMOLITION

5.12.2.2.1. No permittee of any site shall demolish or cause the building demolition or any part without the demolition permit issued by the Authority as prescribed in Part 3 Section 3 and Part 5 Section 1 of this Code.

5.12.2.2.2. Where a condition contemplated in this code arises, the Authority may serve a notice on such person requiring him to make the site safe within such a time as shall

be prescribed in the said notice, and if they fail to do so, the Authority may itself carry out the necessary work at the cost of the owner.

5.12.2.2.3. When a request for demolition has been made by the Authority based on the results of the investigation, the permittee has the right to request for an independent investigation at their own cost for counter verification of the results before accepting demolition works.

5.12.2.3. PRECAUTIONS PRIOR TO DEMOLITION

5.12.2.3.1. Before the demolition is commenced, the owner or the contractor in respect of demolition works shall:

(i) Ensure that no persons are left within the building or in its vicinity; and
(ii) Avoid any fitting attached to the building in connection with any system of street lighting, supply of electricity or other service to be removed

5.12.2.3.2. On every demolition job, perceivable danger signs shall be posted all around the structure and all doors and openings giving access to the structure shall be restricted to use by permitted/authorized persons and functions such as passage of workers or equipment for use in the works. Such signs shall be well light and visible during periods of low visibility and at night.

5.12.2.3.3. Provision shall be made for at least one alternative exit for escape of workers during emergency.

5.12.2.3.4. To manage access to larger sites and to ensure that non-authorized person shall not enter the site of demolition outside working hours; security personnel should be employed.

5.12.2.3.5. If a structure to be demolished has been partially weakened by fire, explosion, earthquake or other catastrophe, such affected parts shall be physically supported suitably before and during demolition.

5.12.2.3.6. It shall be determined if any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any pipes, tanks, or other equipment on the property before any demolition work is commenced .

5.12.2.3.7. When the presence of any such substances is apparent or suspected, testing and purging shall be performed and eliminate the hazard before demolition is started.

5.12.2.4. PROTECTION OF THE PUBLIC

To ensure safety of the public, safety distances shall always be clearly marked and prominently sign posted in connection with Part 12 Section 1 of this Code.

5.12.2.5. PRECAUTIONS DURING DEMOLITION

5.12.2.5.1. All the necessary safety appliances and protective gears and equipment prescribed in Part 12 Section 1 of this Code shall be assured by the contractor and shall always be used by all workers during demolition works.

5.12.2.5.2. Nuisance, noise and dust shall be controlled by suitable means to prevent harm to workers and the public as specified in Part 12 Section 1 of this code.

5.12.2.5.3. Adequate natural or artificial lighting and ventilation shall be provided for the workers as specified Part 12 Section 1 of this Code.

5.12.2.6. SEQUENCE OF DEMOLITION OPERATIONS

5.12.2.6.1. To reduce probability of accidents, all fragile and loose fixtures such as glazed sash, glazed doors and windows, shall be removed first. This shall also apply to lose plaster which shall be stripped off throughout the entire building.

5.12.2.6.2. All wall openings which extend down to floor level, ground level floor, shall be blocked to a height of not less than 0.9m above the floor level. All floor openings and shafts not used for material chutes shall be appropriately sealed and be enclosed with guardrails and toe boards.

5.12.2.6.3. The demolition shall always proceed systematically story by story starting with the top most in a descending order. All work in the upper floors shall be completed and approved by a qualified professional in charge prior to disturbance to any supporting member on the lower floor. Demolition of the structure in sections may be permitted in exceptional cases if reasonable methodology is submitted and proper precautions observed to prevent injuries to persons and damage to property.

5.12.2.7. DEMOLITION OF WALLS

5.12.2.7.1. While walls of sections of masonry are being demolished, it shall be ensured that they are not allowed to fall as single mass upon the floors of the building that are being demolished to avoid exceeding the safe carrying capacity of the floors.

5.12.2.7.2. Overloading of floors shall be prevented by removing the accumulating debris through chutes or by other means immediately. The floor shall be inspected by the qualified professional in charge before undertaking demolition work and if the same floor is found to be incapable to carry the load of the debris; necessary additional precautions shall be taken so as to prevent any possible collapse of the floor.

5.12.2.7.3. During wall demolition, adequate lateral bracing shall be provided for walls which are unstable.

5.12.2.8. DEMOLITION OF FLOORING

5.12.2.8.1. Prior to the removal of masonry or concrete for upper floors, adequate support shall be provided in order to avoid the unexpected collapse.

5.12.2.8.2. When floors are being removed, no workers shall be allowed to work in the area, directly underneath and such area shall be blocked to prevent access to it.

5.12.2.8.3. Planks of sufficient strength shall be provided to give workers firm support to guard against any unexpected floor collapse.

5.12.2.9. DEMOLITIONS OF STEEL STRUCTURES

5.12.2.9.1. When a machine is used, care shall be taken to see that the floor on which it is supported is strong enough for the loading so imposed on it. Where necessary heavy planking shall be used to distribute the machine load to the floor beam and girders for adequate stability of the machine.

5.12.2.9.2. Loading of equipment shall be done carefully to prevent unexpected floor collapse.

5.12.2.9.3. To prevent mixing debris with materials demolished that can be re-used, tag lines shall be used on all materials being lowered or hoisted up and a standard signal system shall be used and the workers instructed on the signals.

5.12.2.9.4. All structural steel members shall be lowered from the building and shall not be allowed to drop.

5.12.2.10. STAIRS, PASSAGEWAYS AND LADDERS

5.12.2.10.1. Stairs with railings in a safe condition, passageways and ladders shall be maintained in good conditions and will only be removed when they are not required for access or adequate alternative for access to places they were being used for has been provided.

5.12.2.10.2. In connection with Part 12 Section 1 of this Code, all ladders shall be secured against slipping out at the bottom and against movement in any direction at the top in order to reduce incidence of slippage and falling.

5.12.2.11. ROOF TRUSSES

5.12.2.11.1. If a building has a pitched roof, the structure should be removed to wall plate level preferably by hand. Sufficient purlins and bracing should be retained to ensure stability of the remaining roof trusses while each individual truss is removed progressively as the qualified professional in charge will indicate.

5.12.2.11.2. Temporary bracing should be added where necessary, to maintain stability of the truss for workers to dismantle safely.

5.12.2.11.3. The bottom tie of roof trusses should not be cut until the principal rafters are prevented from making outward movement.

5.12.2.11.4. Adequate hoisting gears suitable for the loads shall be provided. If during demolition any object is to be put on the floor below the level of the truss, it shall be so done upon certification that the floor is capable of taking such a load.

5.12.2.12. DEMOLITION OF CERTAIN SPECIAL TYPES AND ELEMENTS OF STRUCTURES

For the demolition of special elements which may be dangerous or require special expertise as outlined in 5.12.2.12.1 to 5.12.2.12.11, it shall always be required that a qualified professional be at the site while demolition is taking place.

5.12.2.12.1. HEAVY FLOOR BEAMS

Heavy baulks of timber and steel beams should be supported before cutting at the extremities and should then be lowered gently to a safe working place.

5.12.2.12.2. JACK ARCHES

Where tie rods are present between main supporting beams, these should not be cut until after the arch or series of arches in the floor have been removed. The floor should be demolished in strips parallel to the span of the arch rings (at right angles to the main floor beams).

5.12.2.12.3. BRICK ARCHES

Expert advice should be obtained and, at all stages of the demolition, the close supervision should be given by persons fully experienced and conversant in the type of work to ensure that the structure is stable at all times. In addition, the following shall be observed:

(i) On no account should the restraining influence of the abutments be removed before the dead load of the span fill and the arch rings are removed;

(ii) A single span arch can be demolished by hand, by cutting narrow segments progressively from each springing parallel to the span of the arch, until the width of the arch has been reduced to a minimum which cannot be collapsed;

(iii) Where deliberate collapse is feasible, the crown may be broken by the demolition ball method working progressively from edges to the centre;

(iv) Collapse of the structure can happen in one action by the use of explosives. Charges should be inserted into bore holes drilled in both arch and abutments; and

(v) In multi-span arches, before individual arches are removed, lateral restraint should be provided at the springing level. Demolition may then proceed as for single span; where explosives are used it is preferable to ensure the collapse of the whole structure in one operation to obviate the chance of leaving unstable portion standing.

5.12.2.12.4. IN-SITU REINFORCED CONCRETE

Before starting demolition, the nature and condition of the concrete, the condition and position of reinforcement, and the possibility of lack of continuity of reinforcement should be established. Demolition should start by removing partitions and external non-load bearing cladding.

5.12.2.12.5. REINFORCED CONCRETE BEAMS

A supporting rope should be attached to the beam and the concrete should be removed from both ends by pneumatic drill. The reinforcement should then be cut in such a way as to allow the beam to be lowered under control to the floor.

5.12.2.12.6. REINFORCED CONCRETE COLUMNS

The reinforcement should be exposed at the base after restraining wire ropes that have been placed round the member at the top. The reinforcement should then be out in such a way as to allow it to be pulled down to the floor under control.

5.12.2.12.7. REINFORCED CONCRETE WALLS

These should be cut into strips and demolished as for columns.

5.12.2.12.8. SUSPENDED FLOORS AND ROOFS

The slab should be cut into strips parallel to the main reinforcement and demolished strip by strip. Where ribbed construction has been used, the principle of design and method of construction should be determined before demolition is started. Care should be taken not to cut the ribs inadvertently.

5.12.2.12.9. PRECAST AND PRE-STRESSED REINFORCED CONCRETE

Due precautions shall be taken to avoid toppling over of prefabricated units or any other part of the structure and whenever necessary temporary supports shall be provided for later on construction.

5.12.2.12.10. ASBESTOS CEMENT ROOF AND CEILING

During the demolition of asbestos materials, extra care shall be taken and appropriate protection equipment shall be used. The demolition process and procedure shall conform to the instructions in force determining the procedure for eradication of asbestos materials.

5.12.2.13. CATCH PLATFORM

5.12.2.13.1. In demolition of exterior walls of multi-storey structures or structures more than 6m tall, catch platforms of sufficient strength shall be provided to prevent injuries to workers below and public.

5.12.2.13.2. Such catch platforms shall be constructed and maintained not more than 3 storeys below the storey from which exterior wall is being demolished, the more the height increase the more the falling loads increases. When demolition has progressed to within 3 storeys of the ground level, the catch platform will not be considered necessary.

5.12.2.13.3. Catch platform shall be capable of sustaining a live load of not less than 6.1kN/m^2. Materials shall not be dumped on the catch platform nor shall they be used as means of storage.

5.12.2.14. LOWERING, REMOVAL AND DISPOSAL OF MATERIALS

5.12.2.14.1. Dismantled materials shall be lowered to the ground only after taking adequate precautions. Those materials shall be dumped at specified dumping zones.

5.12.2.14.1.1. Through chutes:

(i) Wooden or metal chutes may be provided for removal of materials. The chutes shall preferably be provided at the center of the building for efficient disposal of debris;

(ii) If chutes are provided at an angle of more than 45° from the horizontal, they shall be entirely enclosed on all the four sides, except for opening at or about the floor level for receiving the materials;

(iii) To prevent the descending material attaining a dangerous speed, chute shall not extend in an unbroken line for more than two stories or 7m, whichever is lower. A gate or stop shall be provided with suitable means for closing at the bottom of each chute to stop the flow of materials;

(iv) Any opening into which workers dump debris at the top of chute shall be guarded by a substantial guardrail extending at least 1m above the level of the floor or other surface on which men stand to dump the materials into the chute; and

(v) A toe board or bumper, not less than 50mm thick and 150mm high shall be provided at each chute openings, if the material is dumped from the wheelbarrows. Any space between the chute and the edge of the opening in the floor through which it passes shall be solidly planked over.

5.12.2.14.1.2. Through holes in the floors:

(i) Debris may also be dropped through holes in the floor without the use of chutes, in such a case the total area of the whole cut in any intermediate floor, one which lies between floor that is being demolished and the storage floor shall not exceed 25% of such floor area. It shall be ensured that the storage floor is of adequate strength to withstand the impact of the falling material;

(ii) All intermediate floor openings for passage of materials shall be completely enclosed with barricades or guard rails not less than 1m high and at a distance of not less than 1m from the edge of general opening. No barricades or guard rails shall be removed until the story immediately above has been demolished to the floor line and all debris cleared from the floor; and

(iii) When the cutting of a hole in an intermediate floor between the storage floor and the floor which is being demolished makes the intermediate floor or any portion of it unsafe, then such intermediate floor shall be properly shored. All supporting walls must be kept with adequate lateral restraints.

5.12.2.14.1.3. Removal of Materials:

(i) As demolition work proceeds, the released serviceable materials of different types shall be separated from the unserviceable lot at suitable time intervals and properly stocked clear of the spots where demolition work is being done;

(ii) In line with Part 7 Section 4 of this code, where applicable, demolition waste shall be recycled in order to be used as secondary materials;

(iii) The unsalvageable debris obtained during demolition shall be collected in well-formed heaps at properly selected places, keeping in view safe conditions for workers in the area. The height of each heap shall be limited to ensure its toppling;

(iv) The unsalvageable debris shall be removed from the demolition site to a location as required by the local authority. Depending on the space available at the demolition site, this operation of conveying debris to its final disposal location may have to be carried out a number of times during the demolition work. In any case, the demolition work shall not be considered as completed and the area declared fit for further occupation until unsalvageable debris has been carried to its final disposal location and the demolition areas tidied up;

(v) All debris shall be covered during transportation;

(vi) Materials that are nuisance or undue environmental pollution in any other way shall be removed from the site at the earliest stage and they shall be suitably covered/ sealed;

(vii) Glass and steel should be dumped or buried separately to prevent injury; and

(viii) The work of removal of debris should be carried out during day under sufficient lighting. Artificial light may be provided in case of poor visibility.

5.12.2.15. MECHANICAL DEMOLITION

When demolition is to be performed by mechanical devices, such as weight ball and power shovels, the following additional precautions shall be observed:

(i) The surrounding area shall be blocked for a minimum distance of three quarters (3/4) of the height of the wall/structure for any to be demolished;

(ii) While the mechanical device is in operation, no workers shall be allowed to enter in the building that is being demolished; and

(iii) The device shall be appropriately located to avoid debris falling on it and prevent the mechanical device from causing damage to adjacent structures, power lines, etc.

5.12.2.16. MISCELLANEOUS

5.12.2.16.1. No demolition work should be carried out during night or at times of poor visibility as far as possible, especially when the structure to be demolished is in an inhabited area. If such night work has to be done, additional precautions by way of additional red warning signals, working lights and watchmen, shall be provided to avoid any injury to workers and public, subject to approval by the Authority.

5.12.2.16.2. Demolition work shall not be carried out during storm and heavy rain.

5.12.2.16.3. Warning devices shall be installed in the area where demolition is being done to warn the public and workers.

5.12.2.16.4. Construction sheds and tool boxes shall be so located as to protect workers from injuries from the falling debris.

5.12.2.16.5. Safety belts or ropes shall be used by workers when working at higher levels.

5.12.2.16.6. All materials and apparatus required in relation to accidents shall be in accordance with Part 12 Section 1 of this Code.

5.12.2.17. GRADING OF PLOT

5.12.2.17.1. When a building has been demolished and no building operation has been projected or approved, the vacant plot shall be filled, graded and maintained in conformity to the established street grades at curb level.

5.12.2.17.2. The plot shall be maintained free from the accumulation of rubbish and all other unsafe and hazardous conditions likely to endanger the life or health of the public. Provisions shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

5.12.2.18. DEMOLITION OF TEMPORARY BUILDINGS

Temporary structures such as reviewing stands and other miscellaneous structures, sheds, canopies or fences, shall be completely removed upon the expiration of the time limit stated in the construction permit.

5.12.2.19. PROHIBITION OF DANGEROUS METHODS

The Authority may prohibit the use of any method to be applied in the demolition of any building where in its opinion such method will create or cause any danger to any person or surrounding buildings or property, and where it so prohibits it shall give its reasons, in writing, for such prohibition.

5.12.2.20. SALE OF MATERIALS

5.12.2.20.1. If a building is demolished by the Authority under any of the powers conferred by this Code, the Authority may remove and sell the materials thereof or any portion of them, and apply the proceeds of the sale in or towards payment of the cost and expenses incurred by it in relation to such work and shall give the balance, if any, to the owner.

5.12.2.20.2. If the proceeds of such sale are insufficient to cover the expenses which the Authority has incurred, the balance shall be recoverable as a civil debt from the owner.

SECTION 3 SANITARY FACILITIES

5.12.3.1. TEMPORARY SANITARY FACILITIES

Sanitary facilities include wash facilities, temporary toilets and portable water fixtures for both male and female.

5.12.3.1.1. WASH FACILITIES

The owner shall install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Supply cleaning compounds appropriate for each

condition. Provide safety showers, eyewash fountains and similar facilities for convenience, safety and sanitation of personnel.

5.12.3.1.2. PORTABLE TOILET FACILITIES

Their use on construction sites shall comply with best management practices for placement. Suggested practices that minimize the potential for storm water pollution from portable toilets and therefore ensure regulatory compliance are listed below:

5.12.3.1.2.1. LOCATION

The toilet shall be placed on a flat and stable ground and as far from storm drain as possible. It shall also provide easy access for pump truck and toilet service staff.

5.12.3.1.2.2. SELCTION, INSTALLATION AND MAINTENANCE

Selection, installation and maintenance of sanitary appliances shall be done in accordance with the requirements given in RS 273. The contractor shall ensure suitable cleaning and maintenance of the toilet to avoid smelling out. Damage, leaks and spills shall be checked regularly and suitably fixed.

5.12.3.1.3. No owner shall commence any building operations unless approved sanitary facilities for personnel have been provided at the building site or at a reasonably close location.

5.12.3.1.4. Sanitary facilities shall be placed in such a position so as not to be offensive and shall always be maintained in a hygienic condition , and shall, unless they are of a permanent nature, be removed by the owner immediately after the completion of the building operations.

5.12.3.1.5. Sanitary facilities shall be provided at the rate of not less than one sanitary facility for every thirty people on the building site.

5.12.3.1.6. Sanitary facilities shall be provided during construction, remodelling or demolition activities.

5.12.3.2. SANITARY FOR PERSON WITH DISABILITIES DURING CONSTRUCTION

5.12.3.2.1. It is essential that sanitary facilities, in accordance with the nature and use of a specific building or facility, be made accessible to and usable by, the persons with disabilities.

5.12.3.2.2. Sanitary facilities shall have space to allow traffic of individuals in wheel chairs. They shall also have at least one water closet.

5.12.3.2.3. Sanitary facilities for men shall, preferably have floor-mounted urinals that are on a reasonable clear height measured from the floor surface of the toilet room.

5.12.3.2.4. Toilet rooms shall have an appropriate number of towel racks, towel dispensers, and other dispensers and disposal units mounted not higher than 910 mm from the floor to be accessed by individuals in wheel chairs.

5.12.3.3. WASTE REMOVAL

5.12.3.3.1. The contractor/permittee shall provide all cleaning and waste removal services including the following:

(i) Clean the project site and work areas daily, including common areas. Coordinate the progress of cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly;

(ii) All waste materials shall be removed from the site before getting rotted.

(iii) Remove debris from concealed spaces before enclosing the space. Burying or burning waste materials on-site will not be permitted. Washing waste down sewers or into waterways will not be permitted;

(iv) Waste materials shall be removed in a manner which prevents injury or damage to persons, adjoining properties and public rights-of-way. The removal shall be done in connection with the approved environmental impact assessment of the project;

SECTION 4: PROTECTION OF PEDESTRIANS & ADJOINING PROPERTY

5.12.4.1. GENERAL REQUIREMENTS

5.12.4.1.1. Pedestrians shall be protected from all kind of activities like construction, remodeling and demolition as required by this section. Signs shall be provided to direct pedestrian traffic.

5.12.4.1.2. If building work is close to or adjacent to adjoining property boundaries, then the owner shall be required to carry out protection work in respect of that adjoining property. This should be done in order to ensure that the adjoining property is not affected or damaged by the proposed building work.

5.12.4.1.3. Before starting the construction works, the contractor gives written notices to the owner of the adjoining properties, safety of which is likely to be affected due to construction works. Where necessary, the contractor shall make adequate provision to protect the safety of adjoining property.

5.12.4.1.4. If the construction practice involves vibration, noise and dust to adjoining structures, the contractor shall make suitable measures to prevent damage. Where, in the vicinity of the construction site, there are old structures which are likely to be affected by the vibration, the contractor shall, with the approval of the Building Consent Authority, appoint tell-tales on such structures to watch their behavior and timely precautions against any undesirable effect.

5.12.4.2. WALKWAYS AND COVERED WALKWAYS

5.12.4.2.1. Every building owner who intends to erect, alter, or demolish any building/ structure and carry out any excavations shall submit to the Authority the plans of such hoardings and covered walkways as shall be necessary for the safety and convenience of any workers employed on the work.

5.12.4.2.2. A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the Building Consent Authority having jurisdiction authorizes the sidewalk to be fenced or closed.

5.12.4.2.3. A temporary walkway of not less than 1.2m wide shall be provided in case there is no sidewalk in front of the building site during construction or demolition.

5.12.4.2.4. Walkways shall be accessible and shall be designed to support all imposed loads and in no case shall the design live load be less than 7.2kN/m^2.

5.12.4.2.5. Adequate lighting shall be provided as per requirements of approved standards by the institution in charge of standards, at all times and a minimum clear height of 2.5m as measured from the floor surface to the canopy overhead shall be provided for all covered walkways.

5.12.4.3. DIRECTIONAL BARRICADES AND CONSTRUCTION RAILINGS

5.12.4.3.1. During lift installation/maintenance, protection against fall shall be provided with suitable barricades for all open lending entrances.

5.12.4.3.2. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

5.12.4.3.3. Where the walkway extends into the street, pedestrian traffic shall be protected by a directional barricade.

5.12.4.3.4. The protective railings on street side shall be required when the walkway occupies part of the roadway and also adjacent to an excavation.

5.12.4.3.5. Adequate railings shall be built substantially strong with at least 1m in height and shall be sufficient to direct pedestrians around construction areas.

5.12.4.4. BARRIERS REQUIREMENTS

Barriers may be required in a range of situations, for security and have to be, therefore, necessarily impenetrable. They shall be constructed and designed to resist all kinds of loads.

5.12.4.5. REPAIR, MAINTENANCE AND REMOVAL

5.12.4.5.1. Pedestrian protections required by this section shall be maintained in place and kept in good order for the entire length of time pedestrians may be endangered.

5.12.4.5.2. The owner or the owner's agent of the construction, after the achievement of the construction activities, shall immediately remove all walkways, debris and other obstructions and leave such public property in as good condition as it was before such work was commenced.

5.12.4.6. PROTECTION FOR ADJOINING PROPERTY

5.12.4.6.1. In order to ensure safety for the adjoining property, adequate temporary protective guards are to be provided. In case these protective devices project beyond the property, the consent of the owner of the adjoining property shall be obtained.

5.12.4.6.2. Afforded the necessary license to enter the adjoining plot, building or structure, the person causing the demolition or excavation to be made shall at all times and at his own expense, preserve and protect it from damage or injury.

5.12.4.6.3. Adjoining property shall be completely protected from any damage incidental to the building operation when the owner of the adjoining property permits free access to the building at all reasonable times to provide the necessary safeguards.

5.12.4.6.4. No person shall at any time during the course of or after the demolition of a building leave it in a condition dangerous to the public or any adjoining property.

SECTION 5: TEMPORARY USE OF STREETS & PUBLIC PROPERTY

5.12.5.1. GENERAL REQUIREMENTS

5.12.5.1.1. No part of any building or structure or any of its appendages shall use the street beyond the property line of building site, except when there is permission from the Building Consent Authority.

5.12.5.1.2. The projection of any structure or appendage over a public property shall be the distance measured horizontally from the property line to the outermost point of the projection.

5.12.5.2. STORAGE AND HANDLING OF MATERIALS

The temporary use of streets or public property for storage or handling of materials or equipment required for construction or execution of such related works, shall comply with the provisions of the applicable governing authority, and shall provide protection to the public at all.

5.12.5.3. OBSTRUCTION

In the event that during construction, demolition, renovation or any other related works arise demand to use more space than intended which may result into obstruction of services and pedestrians, the permittee has to notify the Building Consent Authority and be granted permission to proceed. The permission shall clarify the extent of allowable obstruction and approved duration.

5.12.5.4. UTILITY FIXTURES

Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

SECTION 6: OTHER SAFETY MEASURES, FIRE EXTINGUISHERS & MEANS OF EGRESS

5.12.6.1. GENERAL REQUIREMENTS

5.12.6.1.1. Every contractor carrying out construction work shall comply with the requirements of this section in so far as they affect him or any person carrying out construction work under his control or relate to matters within his control.

5.12.6.1.2. At the construction site, every person working under the control of another person shall report to that person any defect which he is aware may endanger the health and safety of himself or another person.

5.12.6.2. MEANS OF EGRESS AND THEIR MAINTENANCE

5.12.6.2.1. Buildings under construction must be provided with means of escape to ensure that there is a low probability of workers on those buildings being unreasonably delayed or impeded from moving to a place of safety and that those workers will not suffer injury or illness as a result.

5.12.6.2.2. There shall, so far as is reasonably practicable, be suitable and sufficient safe access to and egress from every place of work and to and from every other place provided for the use of any person while at work, which access and egress shall be properly maintained.

5.12.6.2.3. Suitable and sufficient steps shall be taken to ensure, so far as is reasonably practicable, that no person uses access or egress, or gains access to any place, which does not comply with the requirements of regulation 5.12.6.2.2.

5.12.6.2.4. The provision of means of egress on the construction site shall conform to Part 10 Section 1 of this Code.

5.12.6.3. ACCESS TO THE UPPER FLOORS DURING CONSTRUCTION

5.12.6.3.1. In all buildings over two storeys high (G+1), at least one stairway shall be provided in usable condition at all times. This stairway shall be extended upward as each floor is completed. There shall be a handrail on the staircase.

5.12.6.3.2. Where a building has been constructed to a building height of 15m or four storeys, or where an existing building exceeding 15m in building height is altered, at least one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected as the construction progresses.

5.12.6.4. EMERGENCY ROUTES AND EXITS

5.12.6.4.1. Where necessary in the interests of the health and safety of any person on a construction site, a sufficient number of suitable emergency routes and exits shall be provided to enable any person to reach a place of safety quickly in the event of fire or other danger.

5.12.6.4.2. An emergency route or exit provided pursuant to sub-regulation 5.12.6.4.1 shall lead as directly as possible to an identified safe area.

5.12.6.4.3. An emergency route or exit provided in accordance with sub-regulation 5.12.6.4.1, and any traffic route giving access thereto, shall be kept clear and free from obstruction and, where necessary, provided with emergency lighting so that such emergency route or exit may be used at any time.

5.12.6.4.4. The provision of emergency route during construction shall comply with Part 10 Section 2 of this Code and the instructions in force relating to the fire prevention in Rwanda.

5.12.6.5. FIRE HAZARDS AND FIRE-FIGHTING EQUIPMENT

5.12.6.5.1. The provisions of Part 9 of this Code and the instructions in force relating to the fire prevention in Rwanda shall be observed to safeguard against all fire hazards attendant upon construction operations.

5.12.6.5.2. Suitable and enough steps shall be taken to prevent, as so far as reasonably practicable, the risk of injury to any person during the carrying out of construction work arising from fire and/or explosion.

5.12.6.5.3. Where necessary, in the interest of the health and safety of any person working on the construction site, the contractor shall insure suitable and sufficient fire-fighting equipment, and fire detection systems which shall be suitably located and secured in respect to Part 9 of this Code. The fire-fighting equipment shall be installed before starting the construction.

5.12.6.5.4. Any fire extinguisher and fire detection system provided under sub-regulation 5.12.6.5.3 shall be examined and tested at suitable intervals and properly maintained as per the requirements of Part 9 Section 9 of this Code.

5.12.6.5.5. Any fire-fighting equipment which is not designed to come into use automatically shall be easily accessible.

5.12.6.5.6. Every person at work on a construction site shall be instructed on the correct use of any fire extinguisher and other portable firefighting equipment which may be necessary to use.

5.12.6.5.7. Where a work activity may give rise to a particular risk of fire, no person shall carry out such work unless they are suitably instructed.

5.12.6.5.8. Firefighting equipment shall, as reasonably practicable, be visible and their location and identification, suitably indicated by appropriate symbolic signs.

5.12.6.6. REQUIRED PORTABLE FIRE EXTINGUISHERS

5.12.6.6.1. All structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher in accordance with Part 9 Section 4 of this Code and sized for not less than ordinary hazard as follows:

(i) At each stairway on all floor levels where combustible materials have accumulated,

(ii) In every storage and construction shed.

5.12.6.6.2. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

RWANDA BUILDING CODE

Chapter Five:
CONSTRUCTION SAFETY, INSPECTION, MAINTENANCE & DISASTER RISK MANAGEMENT

PART 13:

EXISTING STRUCTURES

SECTION 1: STRUCTURAL ADDITIONS, ALTERATIONS & REPAIRS
SECTION 2: CHANGE OF OCCUPANCY
SECTION 3: FIRE ESCAPES
SECTION 4: COMPLIANCE ALTERNATIVES

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PART 13: EXISTING STRUCTURES

SECTION 1: STRUCTURAL ADDITIONS, ALTERATIONS & REPAIRS

5.13.1.1. GENERAL REQUIREMENTS

5.13.1.1.1. Additions, or alterations shall not be made to any existing structure or building which will cause them to be in violation nor shall such additions or alteration cause the existing building or structure to become unsafe or in any way adversely affect its stability, ventilation, fire safety means of egress, sanitation or the general performance of the building as outlined in Part 8 and Part 10 of this Code.

5.13.1.1.2. The totality of any building so altered which involves a change in use or occupancy, shall not exceed the height, number of floors, and area permitted for new buildings, including the new additions if any.

5.13.1.1.3. Any person who constructs or makes an alteration to a building shall erect and maintain hoardings throughout the execution of the works as necessary to protect the public.

5.13.1.2. STRUCTURAL REQUIREMENTS FOR ADDITIONS, ALTERATIONS AND REPAIRS OF EXISTING STRUCTURES

5.13.1.2.1. The structural engineer shall make a structural evaluation of the existing building to determine the adequacy of all structural systems that are affected by alteration, addition, change of use, or damage to be repaired.

5.13.1.2.2. The evaluation shall include review of relevant available documentation about the building design and construction, a field investigation of the existing conditions, and a structural analysis. When deemed necessary by the structural engineer, the evaluation shall also include detailed field surveys, testing and laboratory analysis.

5.13.1.2.3. When new structural elements or strengthening of existing elements is necessary, the evaluation shall include the effects of such new elements on the entire building.

5.13.1.3. SURVEY OF ADDITION/ALTERATION TO THE BUILDING STRUCTURE AND THE SURROUNDINGS

5.13.1.3.1. State whether any addition and alterations have given rise to excessive loading or other adverse effects on the slope protection system.

5.13.1.3.2. State whether any addition and alterations have affected building services, infrastructural services and other land uses.

5.13.1.3.3. The field investigation of an existing building shall be sufficient to determine the location, size, details and conditions of existing structural elements, and to verify structural information on the drawings of the existing building, if said drawings exist.

5.13.1.4. STRUCTURAL ANALYSIS

The structural analysis shall include analysis of all structural systems affected by the proposed alteration, addition, or change in use or repair.

5.13.1.5. STRUCTURAL ADDITIONS

An addition that is structurally independent from existing structures shall be designed and constructed in accordance with the provisions of Part 6 of this Code.

5.13.1.6. STRUCTURAL REPAIRS

Repair or reinforcement of the existing structural elements or systems shall be designed and constructed in accordance with the requirements of new construction as outlined in Part 6 of this Code.

5.13.1.7. OCCUPATION OF BUILDINGS UNDER CONSTRUCTION

A building or portion of the building may be occupied during reconstruction, repairs, alterations or additions provided the issuance of the temporary occupation permit in for Part 5 Section 17.

SECTION 2: CHANGE OF OCCUPANCY

5.13.2.1. GENERAL REQUIREMENTS

5.13.2.1.1. A certificate of occupancy shall be required where a change of occupancy involves the change of building classification by type of use and occupancy as provided in Part 4 Section 2 of this Code.

5.13.2.2. CONFORMANCE

5.13.2.2.1. No change shall be made in the use or occupancy of any building that would place the building in a different division of the same group of occupancy or in a different group of occupancies, unless such building is made to comply with the requirements of this Code for such division or group of occupancy.

5.13.2.2.2. Subject to the approval of the Authority, the use or occupancy of existing buildings shall be permitted to be changed and the building is allowed to be occupied for purposes in other groups without conforming to all the requirements of this Code for those groups, provided the new or proposed use is less hazardous, based on life and fire risk, than the existing use.

5.13.2.3. CERTIFICATE OF OCCUPANCY

5.13.2.3.1. A certificate of occupancy shall be issued where it has been determined that the requirements for the new occupancy classification have been met in accordance with Part 3 Section 3 of this Code.

5.13.2.3.2. No change in the existing occupancy classification of a building or structure or portion thereof shall be made, until the Authority has issued a certificate of occupancy.

5.13.2.4. PARTIAL CHANGE OF OCCUPANCY

Where a portion of the building is changed to a new occupancy classification, any alterations shall comply with the alteration requirements of this Section.

5.13.2.5. COMPLETE CHANGE OF OCCUPANCY

5.13.2.5.1. When change of occupancy results in a structure being re-classified to a higher occupancy category, the structure shall conform to the strength requirements for a new structure of the higher occupancy category.

5.13.2.5.2. Existing buildings, or portions thereof, that undergo a change of group or occupancy shall also comply with the requirements for alteration covered under this Part and they shall have all of the following accessible features:

(i) At least one accessible building entrance;

(ii) At least one accessible route from an accessible building entrance to primary function areas;

(iii) Accessible parking, where parking is being provided; and

(iv) At least one accessible passenger loading zone, when loading zones are provided.

SECTION 3: FIRE ESCAPES

5.13.3.1. GENERAL REQUIREMENTS

5.13.3.1.1. Fire escapes shall be permitted only as provided in this section with supplements of Part 8, Part 9 and Part 10 of this Code.

5.13.3.2. EXISTING FIRE ESCAPES

5.13.3.2.1. Existing fire escapes shall be continued to be accepted as a component in the means of egress in existing buildings only.

5.13.3.2.2. A number of exits required in the escape routes in buildings shall comply with the provisions of Part 10 Section 2 of this Code.

5.13.3.3. NEW FIRE ESCAPES

New fire escapes for existing buildings shall be permitted only where exterior stairs cannot be utilized due to lot lines limiting stair size or due to the sidewalks, alleys or roads at grade level. New fire escapes shall not incorporate ladders or access by windows.

5.13.3.4. LOCATION

5.13.3.4.1. Where located on the front of the building and where projecting beyond the building line, the lowest landing shall not be less than 2.1m or more than 3.6m above grade, and shall be equipped with a counterbalanced stairway to the street. In alleyways and thoroughfares less than 9.1m wide, the clearance under the lowest landing shall not be less than 3.6m.

5.13.3.4.2. Fire escapes like other required elements of a means of egress shall not project more than 1.2m beyond the face of the wall.

5.13.3.5. CONSTRUCTION

5.13.3.5.1. The fire escape shall be designed to support a live load of 4.8kPa and shall be constructed of steel or other approved non-combustible materials.

5.13.3.5.2. Fire escapes constructed of wood not less than nominal 50mm thick are permitted on buildings with which the structural elements, exterior walls and interior walls are of any materials permitted by this Code. Walkways and railings located over or supported by combustible roofs in such buildings are permitted to be of wood not less than nominal 50mm thick**.**

5.13.3.6. DIMENSIONS

5.13.3.6.1. Fire escape stairways shall be of the dimensions not less than those specified for domestic buildings in Part 11 Section 6 of this Code and in special circumstances, the Authority may allow the use of an approved type of escape ladder or any other equipment in place of escape stairways.

5.13.3.6.2. Stairs shall be at least 0.6m wide with risers not more than 0.2m, and treads not less than, 0.2m and landings at the foot of stairs not less than 1m wide by 0.9m long, located not more than 0.2m below the door.

5.13.3.7. OPENING PROTECTIVE

Doors and windows along the fire escape shall be protected to 45 minutes fire resistant opening protective.

5.13.3.8. MAINTENANCE OF FIRE ESCAPES

5.13.3.8.1. All fire escape routes shall be well maintained and shall comply with the requirements for emergency routes as provided in Part 12 Section 6 of this Code.

5.13.3.8.2. A fire escape route or exit provided in accordance with this section, and any traffic route giving access thereto, shall be kept clear and free from obstruction and, where necessary, provided with emergency lighting so that such escape route may be used at any time.

5.13.3.8.3. All fire escape routes or exits shall be indicated by suitable signs.

5.13.3.8.4. All fire escapes shall be kept free of slippery materials. Fire escapes shall be painted in an approved manner before and after erection; and shall be scraped and painted as often as necessary to maintain them in safe condition.

SECTION 4: COMPLIANCE ALTERNATIVES

5.13.4.1. APPLICABILITY

5.13.4.1.1. All kind of additions, alterations or changes of occupancy for the existing building shall be made to conform to the requirements of this Section and Part 13 Sections 1through3 of this Code.

5.13.4.1.2. Where an existing building is changed to a new occupancy classification and this section is applicable, the provisions of this section for the new occupancy shall be used to determine compliance with this Code.

5.13.4.1.3. If there is a portion separated to an existing building with barriers and changed to a new classification, the portion changed shall be made to conform to the provision of this Code. The greater public safety shall apply to the entire building or structure and shall comply with this Part 4 Section 3.

5.13.4.1.4. The portion altered or repaired shall conform to the requirements of this Code to the existing building when the current level of safety or sanitation is to be reduced.

5.13.4.2. INVESTIGATION AND EVALUATION

5.13.4.2.1. The contractor or the owner of the works represented in 5.13.4.1.2 and 5.13.4.1.3 shall cause the existing building to be investigated and evaluated in accordance with the provisions of this Section and Part 14 Section 1of this Code.

5.13.4.2.2. The contractor or the owner shall have a structural analysis of the existing building made to determine adequacy of structural systems for the proposed alteration, addition or change of occupancy.

5.13.4.2.3. The results of the investigation and evaluation, along with proposed compliance alternatives, shall be submitted to the Authority.

5.13.4.3. EVALUATION PROCESS

5.13.4.3.1. The evaluation shall be comprised by fire safety, means of egress and general safety, as defined in Parts 8 to 10 of this Code. The evaluation process specified herein shall be followed in its entirety to evaluate existing buildings.

5.13.4.3.2. Evaluate the compartments created by fire barriers or horizontal assemblies which comply with fire wall and floor/ceiling construction and which are exclusive of the wall elements considered under 5.13.4.3.3 and 5.13.4.3.4.

5.13.4.3.3. A wall used to create separate compartments shall be a fire barrier with a fire resistance complying with Part 8 Section 4 of this Code. Where there is more than one compartment with a story, each compartmented area on such story shall be provided with a horizontal exit and the fire door that such fire door will provide a substantial barrier to the passage of smoke.

5.13.4.3.4. Evaluate the fire-resistance rating and degree of completeness of walls which create corridors serving the floor, and constructed in accordance with Part 8 Section 2 of this Code. This evaluation shall not include the wall elements considered in 5.13.4.3.2 and 5.13.4.3.3

5.13.4.3.5. Evaluate the ability of the Heating Ventilation Air Conditional system to resist the movement of smoke and fire beyond the point of origin. Evaluate also the smoke detection capability based on the location and operation of automatic fire detectors in accordance with Part 8 Section 5 of this Code.

5.13.4.3.6. Evaluate the means of egress capacity and the number of exits available to the building occupants. In applying this Section, the means of egress are required to conform to Part 10 Section 1 of this Code.

5.13.4.3.7. Where a building has two or more occupancies that are not in the same occupancy classification, the separation between the mixed occupancies shall be evaluated in accordance with this section. The evaluation of the ability to suppress a fire based on the installation of an automatic sprinkler system is done in accordance with Part 9 Section 1 of this Code.

RWANDA BUILDING CODE

Chapter Five:
CONSTRUCTION SAFETY, INSPECTION, MAINTENANCE & DISASTER RISK MANAGEMENT

PART 14:

INSPECTION, MAINTENANCE & DISASTER RISK MANAGEMENT

SECTION 1: INSPECTION
SECTION 2: MAINTENANCE OF EXISTING BUILDINGS & INSTALLATION
SECTION 3: DISASTER RISK MANAGEMENT CONSIDERATIONS

CONTENTS

PART 14: INSPECTION, MAINTENANCE & DISASTER RISK MANAGEMENT

SECTION 1: INSPECTION

5.14.1.1. GENERAL REQUIREMENTS OF THE INSPECTION

5.14.1.1.1. For different stages of the inspection as specified by this Section, the written notification shall be made by the permittee to the Building Consent Authority calling for the inspection of the completed stage before proceeding to the next one.

5.14.1.1.2. The Authority shall have the right to inspect and visit any plot or building, between the working hours from Monday to Friday, in order to ascertain that the requirements of this code and the approved plans are being observed.

5.14.1.1.3. The inspector shall request documents allowing him/ her to get the necessary information on the nature and the condition of the building. He/she shall examine all documents as specified by present code and shall fill in the inspection forms including the violation notification slip (if applicable) according to the Authority.

5.14.1.1.4. After conducting the inspection, in case of any violation, the inspector shall fill in the violation notification slip which shows the type of violations and related penalties. The slip shall be signed by the inspector and the owner representative (contractor or supervisor) on site. A copy of the violation notification slip shall be submitted to the owner representative on site.

5.14.1.1.5. In the line of the instructions in force relating to fire prevention, all public building shall be inspected for fire safety at every three years interval. For the storage of inflammable materials, the fire safety inspection shall be done every year.

5.14.1.1.6. Maintenance and repair of concrete structures to assess existing structures, design of repairs and prevention shall be done in accordance with the requirements of relevant parts of ISO 16311. On-Site Inspection of Installed Firestops shall be done in accordance with ASTM E2174. Periodic inspection and on-site inspections of building facades for unsafe conditions shall be done in accordance with ASTM E2841 and ASTM E2270 respectively.

5.14.1.2. QUALIFIED PERSONS AND PREPARATION OF SITE INSPECTION

5.14.1.2.1. The qualification of persons allowed to conduct the site inspection shall comply with those set out in Part 3 Section 2 of this code.

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

(i) A copy of the building file including the approved plans and the previous inspection reports;
(ii) Inspection forms according to the items intended to be inspected; and
(iii) The site inspection tools depending on the type and stage of inspection to be conducted.

5.14.1.3. BUILDING INSPECTION BASED ON STAGE OF CONSTRUCTION

5.14.1.3.1. According to the construction processes, a building construction project shall be divided into three stages of execution: before, during and after execution of works. For the effectiveness of the inspection works, all building projects shall be inspected at least once for each stage of execution.

5.14.1.3.2. The stages of inspection shall go along with construction processes as follows:

(i) Stage 1: Before construction works:
This stage of inspection is conducted after a building permit issuance and it covers the site mobilization and set out inspection;

(ii) Stage 2: During construction works:
This stage includes the inspection of excavation, foundation, building structure, masonry works, finishing, landscaping and any other inspection which might be proposed by the Authority during the construction process; and

(iii) Stage 3: After construction works:

This stage includes the joint site inspection as 5.14.1.9 conducted for the issuance of occupation permit Freehold title and the periodic inspection conducted during occupancy period as 5.14.1.10.

5.14.1.3.3. Notwithstanding other previsions of this Code, the foundation inspection and joint site inspection shall only be mandatory during and after construction, respectively. In any case, the Building Setting out Self Certification Form as Form 6 in Part 14 Section 4 shall be referred to for the site mobilisation and set out inspection.

5.14.1.4. INSPECTION OF THE SITE MOBILISATION AND SET OUT

5.14.1.4.1. The checklist shown in Form 1 of Part 14 Section 4 shall be adopted during the inspection of site mobilisation and set out.

5.14.1.4.2. The inspector shall use the distance measuring tools to compare current dimensions with those on the approved plans.

5.14.1.4.3. In addition to the items outlined in Form 1 in Part 14 Section 4, the inspector shall also check if all public utilities are protected.

5.14.1.5. INSPECTION OF THE EXCAVATION AND EARTHWORKS

5.14.1.5.1. The checklist shown in Form 2 Part 14 Section 4 shall be adopted during the inspection of the excavation and earthworks.

5.14.1.5.1.1. The requirements of safe-guard during excavation and earthworks shall be respected as described in Part 12 Section 1 of this Code.

5.14.1.6. INSPECTION OF FOUNDATION WORKS

5.14.1.6.1. The checklist shown in Form 3 in Part 14 Section 4 shall be adopted during the inspection of the foundation works.

5.14.1.7. INSPECTION OF SUPERSTRUCTURE WORKS

5.14.1.7.1. The checklist shown in Form 4 in Part 14 Section 4 shall be adopted during the inspection of the excavation and earthworks.

5.14.1.7.2. In addition to the items outlined in Form 4 in Part 14 Section 4, the inspector shall also check the safety condition of scaffoldings and formworks. He/she shall verify if:

(i) Bolts and nuts of the scaffolding/ formworks are tightened enough;
(ii) The erected scaffold ensures easy and safe circulation on the site;
(iii) The materials, the techniques and procedures used for the scaffold comply with Part 12 Section 1 of this Code; and
(iv) For elevation works, the inspector shall identify critical areas of the building especially for general structural, columns, slabs, beams, stair cases and pay special attention to them.

5.14.1.7.3. The inspector shall verify if:

(i) The strength of finished concrete members is beyond minimum admissible strength and the elastic properties of casted concrete members are compliant with specification in the bills of quantities. The Schmidt hammer shall be used;
(ii) The visible cracks cannot affect the structural stability; and
(iii) The procedures, methods, techniques and onsite-fabricated materials comply with 6 and Part 7 of this Code.

5.14.1.7.4. For the fire protective measures, the inspector shall check if:

(i) The location of installed facilities and equipment comply with approved plans;
(ii) The fixtures and equipment used comply with the specifications in the approved Bills of Quantities; and

(iii) The personnel on site have skills on fire fighting equipment and skills on the usage of First Aid Kit.

5.14.1.7.5. In regards of facilities for persons with disabilities, the inspector shall check if the location of installed facilities, equipment, procedures and techniques comply with the approved plans and Part 10 Section 3 of this Code.

5.14.1.8. INSPECTION OF FINISHING AND LANDSCAPING

5.14.1.8.1. For the interior finishes, the inspector shall check if:

(i) The executed finishing works comply with approved plans

(ii) All the electrical installation is grounded. The natural/electrical light is sufficient. The power saving technology and economic lights are used onsite.

5.14.1.8.2. For the exterior finishes, the inspector shall check if:

(i) The executed finishes comply with approved plans;

(ii) The landscaping stage includes parking area, walkways, lighting and splash aprons. According to these stages the inspector shall check if landscaping installations comply with the approved landscape plans and in conformity with Part 5 of this Code.

5.14.1.9. JOINT SITE INSPECTION

5.14.1.9.1. The joint site inspection shall be conducted after the construction works to check the compliance to the approved plans, zoning regulations, safety, health and security to confirm the completion of the construction works and issuance of the occupation permit and Freehold title.

5.14.1.9.2. The inspector shall verify the conformity of the building according to the approved plans and Registered Construction *and Supervision firms*

Name of The Construction Firm:	Name of the Supervision Firm:

Registration / Licence Number:	Registration / Licence Number:
Site Engineer's Name: Contact details Cell phone: Email:	Site Engineer's Name: Contact details Cell phone: Email:
Date and Signature of the site Engineer	Date and Signature of the site Engineer

1. Building Consent Authority Inspectors

S/N	Names	Signature
1		
2		
3		
4		

5.14.1.9.3.

5.14.1.9.4.

5.14.1.9.5.

5.14.1.9.6. ***Form 5*** in Part 14 Section 4 shall suitably be used.

5.14.1.10. PERIODIC INSPECTION AFTER THE OCCUPANCY

5.14.1.10.1. After the building occupation, the periodic inspection shall be carried out depending on the building type and classification or when it is required by the Building Consent Authority. However, the fire safety inspection shall be conducted at least once per year.

5.14.1.10.2. Registered Construction *and Supervision firms*

Name of The Construction Firm: Registration / Licence Number:	Name of the Supervision Firm: Registration / Licence Number:

Site Engineer's Name: Contact details Cell phone: Email:	Site Engineer's Name: Contact details Cell phone: Email:
Date and Signature of the site Engineer	Date and Signature of the site Engineer

2. Building Consent Authority Inspectors

S/N	Names	Signature
1		
2		
3		
4		

5.14.1.10.3.

5.14.1.10.4.

5.14.1.10.5.

5.14.1.10.6. ***Form 5*** in Part 14 Section 4 shall suitably be adopted during the periodic inspection.

5.14.1.11. RISK BASED INSPECTION

5.14.1.11.1. The inspector shall check the general status of the building in relation to safety, disaster, fire resistance and any other factor which, according to the Authority, might influence the general safety of the building.

5.14.1.11.2. The risk based inspection of the building of Group A to Group MISC is conducted to access the general safety and the resistance against fire. However, for the case of single story building classified in sub-groupB-3, E-2, F-4, I-3 and R-5 this inspection is not mandatory.

5.14.1.12. INSPECTION OF DEMOLITION

5.14.1.12.1. The Inspector shall verify if:

(i) The recommended techniques, tools and machinery as per the demolition permit are respected;

(ii) The sealing of services and the protection of public utilities have been done before starting demolition;

(iii) The dust reduction/mitigation measures used are efficient in protecting surroundings;

(iv) The dumping areas are appropriate and well managed; and the security measures are provided; and

(v) The requirements described in Part 12 Section 2 of this Code are respected.

5.14.1.13. INSPECTION TOOLS

For all inspection works, appropriates tools shall be used in regard to the type and stage of inspection.

5.14.1.14. SPECIAL INSPECTION

5.14.1.14.1. Where deemed necessary, the Building Consent Authority may request the contractor/owner to conduct the special inspection during construction on the type of being conducted. This inspection is in addition to the other inspections discussed in 5.14.1.4 to 5.14.2.11.

5.14.1.14.2. Discrepancies shall be brought to the immediate attention of the contractor for correction.

5.14.1.15. REPORT OF THE RESULTS OF AN INSPECTION

5.14.1.15.1. A report of the results of an inspection shall comprise:

(i) Detailed description of the visual inspection and any full structural and full building condition or services investigation;

(ii) Analysis of observations and tests conducted in course of full structural, full building condition or services investigation;

(iii) Recommendations and comments by the registered professionals as to such the necessary remedial works of full structural, full building condition or services and stability of the building; and

(iv) After the evaluation of inspection report, the Authority shall afterwards:

a. Issue a compliance certificate to the contractor who represent the owner of the building;

b. Issue an order to the contractor to take the appropriate measures to remedy any deformation or deterioration as recommended by the qualified person; and

c. Request the contractor/ owner to demolish the building if the Authority has found that it cannot be repaired to a safe condition.

SECTION 2: MAINTENANCE OF EXISTING BUILDINGS & INSTALLATIONS

5.14.2.1. GENERAL REQUIREMENTS

5.14.2.1.1. The maintenance frequency of each building element shall be planned at the design stage. Decisions to repair or replace should be taken after inspections according to Part 14 Section 1 of this Code.

5.14.2.1.2. Temporary access equipment shall be appropriately provided for maintenance work, this equipment ranges from ladders to scaffoldings or powered lift platforms.

5.14.2.1.3. All personnel employed for carrying out maintenance should be provided with the necessary protective clothing and equipment in accordance with Part 12 Section 1 of this Code.

5.14.2.1.4. Special precautions need to be taken when entering a confined space. Such confined spaces should be adequately ventilated, particularly before being entered, to ensure that they are free from harmful concentrations of gases, vapours other air borne substances and that the air is not deficient in oxygen.

5.14.2.1.5. Good lighting is necessary in order that maintenance work can be carried out satisfactorily. This is particularly important in confined spaces. When the normal lighting is inadequate it should be supplemented by temporary installations. These should provide general and spot illumination as appropriate.

5.14.2.2. MAINTENANCE OF EXISTING BUILDINGS AND INSTALLATIONS

5.14.2.2.1. All installations in an existing building and the building itself shall be required to be properly maintained by the owner(s) of the building to insure that it is in good conditions for use and meet the minimum safety and health standards as specified Part 12 Section 1 of this Code so as to ensure protection of both the user and the general public from any health/safety hazards.

5.14.2.2.2. It shall be illegal to remove or make any installations unsafe for use by occupants of such building either by the owner, occupant or general user.

5.14.2.3. IDENTIFICATION OF THE NEED FOR MAINTENANCE

The need of maintenance shall be guided by routine inspection of the building on a regular basis through defect identification, defect analysis and determination of the existing buildings' condition, and including proposals for repair or further investigation.

5.14.2.4. REPAIR WORK AND OWNERSHIP RESPONSIBILITIES

5.14.2.4.1. The owner of any building or common property shall ensure that the ground is always kept in a clean and tidy condition.

5.14.2.4.2. The garden, whether paved or turfed, is regularly swept and kept reasonably clean and that any overgrown grass cut regularly, that trees, hedges and shrubs are well maintained by pruning and/or trimming.

5.14.2.4.3. Parking lots are properly demarcated (to be repainted where applicable and when necessary) to ensure the parking of vehicles in an orderly manner and vehicles are not parked otherwise than in the parking lots.

5.14.2.4.4. Debris and any litter are swept, while culverts and cover slabs are in a good state of repair and that the drainage system is free of stagnant water. Any person who disposes of the contents of a chemical toilet into a body of water or in any manner other than that prescribed by the existing regulations for health shall be considered to have committed an offence and shall be liable for conviction and/or fine according to laws in force in Rwanda.

5.14.2.4.5. The recreational areas and playgrounds, pergolas, benches, play equipment and all recreational facilities are kept in a clean condition and good order and that a proper and adequate refuse in centre is-provided which is well labelled, kept clean, free from odour, flies and vermin, and in a proper state of repair, and arrangement is made with the proper authorities to empty the refuse regularly and to replace any refuse bins when damaged.

5.14.2.4.6. Gutters, gates and fences, windows and doors (including panels, grilles, louvers panes, ventilators and awnings) are regularly painted and are kept in good order and (including wall fences and railings) are repaired when damaged. This is done to the satisfaction of the Authority.

5.14.2.4.7. All installations which include lifts, escalators, sewers, septic tanks, lights, gas, hot and cold water, air conditioning, tanks, pumps, generators, motor fans, compressors, cables, wires, pipes, switches, meters, gauges and all apparatus and installation existing for common use are kept in a proper working condition and serviced regularly. The internal walls of the building are neat and tidy in appearance

while exterior painting is being done at least once in 5years to the satisfaction of the Authority or such shorter period as the Authority may require.

5.14.2.4.8. The corridors, passages, landings, staircases, escalators, air wells, walls, ceilings, fire escapes, entrances and exits of buildings, basements, car parks, roof and roof gardens, recreational or community facilities, refuse chutes, common storage spaces, common toilets and latrines are kept clean, free of any slippery causing agents, repaired and well maintained, free of any mutilations, scribbling or drawings on the walls, floor and ceiling. Redecoration shall be done when necessary.

5.14.2.4.9. Adequate ventilation and lighting, whether natural or artificial, are provided to the entire building in general and in particular all passages, landings, staircases, lifts and hallways and any blown fuses, bulbs or defective wires and switches are immediately replaced. Obstructing materials such as boxes and bottles shall not be stacked along the passage of a building;

5.14.2.4.10. Where excessive rubble, rubbish, other debris or combustible waste material has been allowed to accumulate on a site before, during or after building operations, the Authority may serve notice on the owner to cause the rubble, rubbish, other debris or combustible waste material to be removed from the building site within a specified period. If the owner of the building operations fails to comply with the notice, he/she is considered to have committed an offence and is liable on conviction to a fine that the jurisdiction of Rwanda find appropriate.

5.14.2.4.11. Mechanical ventilation, lifts, boilers and hot water, warm water and cooling water systems must be thoroughly examined and inspected and adequately maintained to safeguard users and the public from Illness or injury.

5.14.2.4.12. Mechanical installations for access into, within and out of the buildings shall provide, for the safe and easy movement of people, and for the safety of

maintenance personnel, safeguard maintenance personnel from injury while servicing mechanical installations for access,

5.14.2.4.13. Mechanical installations for access shall:

(i) Move people safely, and stop and hold as required for the normal use of the installation, for all loads up to and including 25% in excess of the rated load;

(ii) Be constructed to avoid the likelihood of people falling, tripping, becoming caught, being able to touch or be struck by moving parts, sharp edges or projections, under both normal and reasonably foreseeable abnormal conditions of use;

(iii) Be constructed to prevent collision between components, or between components and the building;

(iv) Have a control system that ensures safe abnormal operation in the event of overloading or failure of any single component; and

(v) Be capable of being isolated for inspection, testing and maintenance.

5.14.2.4.14. Maintenance of industrial lifts and loading ramps shall be provided in accordance with manufacturer's maintenance manual and design specifications.

SECTION 3: DISASTER RISK MANAGEMENT CONSIDERATIONS

5.14.3.1. DESIGN AND CONSTRUCTION CONSIDERATIONS

5.14.3.1.1. All natural disasters likely to affect the region where the construction services are taking place, including earthquakes, rainstorms, floods, lightning and landslides, shall be taken into consideration during the design stage and wherever possible, these shall be catered as per Part 6 Section 2 of this Code.

5.14.3.1.2. The design plans shall be accompanied by structural sufficiency certificate signed by the professional civil /structural engineer to the effect that the building is safe against various applicable loads, forces and effects including earthquakes as per Part 6 Section 2 of this Code.

5.14.3.1.3. In disaster high wind and seismic areas, good construction practices shall be followed taking care of joints, their damping and possible ductility including those set out in Part 15 Section 1 of this Code.

5.14.3.1.4. All design and construction shall be carried out by competent and registered professionals and suitably qualified/ classified firms.

5.14.3.1.5. Suitable drainage of sites and protection of structures against flooding and water logging shall be ensured in design and construction in line with the requirements of Part 11 Section 10 and Part 15 Section 1.

5.14.3.1.6. All design and construction shall take into consideration lightning occurrences.

5.14.3.1.7. Implementation / execution of any changes in the design and construction shall not be undertaken unless suitably approved by the Authority.

5.14.3.2. INDEMNITY AGAINST DAMAGES

5.14.3.2.1. Where any building operation may cause or have any detrimental effect on the strength, standard, safety, quality or position of any other property or public utility, the Authority shall require the owner executing the building operations to

indemnify it against claims for damages that may arise from the building operations with an insurance bond.

5.14.3.2.2. The Authority shall determine the sum of the indemnity for any one claim and the number of claims shall be unlimited.

5.14.3.2.3. The indemnity shall be kept in force for as long as the Authority determines appropriate, but not after the occupancy Permit has been issued.

5.14.3.3. DUTIES OF PROJECT STAKEHOLDERS

5.14.3.3.1. The contractor/ owner shall provide the pre-construction information consisting of any information about previous records which can affect the site or construction work and any information concerning the proposed use of the structure as a workplace.

5.14.3.3.2. The designer shall be involved in preparing or modifying a design which may be used in construction work to avoid foreseeable risks to the health and safety of any person carrying out construction work or using a structure designed as a workplace.

5.14.3.4. SITE LOCATION

No construction shall be undertaken on any site without approval of the Authority and consideration of the appropriate provisions of Part 15 Section 1 of this Code

5.14.3.5. DISASTER PREVENTIVE ACTIONS

Every person taking part in construction work shall ensure that such work is carried out in compliance with the safety measures set out in other parts of this Code.

SECTION 4: INSPECTION FORMS

Form 1: SITE MOBILISATION AND SETOUT CHECKLIST

1. Site identification and Contractor details

Developer/ Owner's names:
Name of the project:
Project Location Province / City: District: Sector: Cell: Unique Parcel Identifier:
Number of floors:
Occupancy Classification Group: Class: Sub-group:
Contractor's details Contact name: Phone number: Email:

2. Detailed Inspection

SN	Description	Yes	No	Comments
1	The site and boundary demarcation comply with the approved plans			
2	The road reserve complies with the zoning location and approved plans			
3	All setbacks comply with the zoning location and approved plans			
4	The demarcation holdings/netting are provided to delineate required work areas			
5	Set up areas for operation of the site are compliant with approved plans.			
6	Machinery installed on site are in the right place and do not impair proper functioning on the site.			
7	Offices, sanitary, storages and any other working areas are provided			
8	Required working areas are available and do not interfere with general site circulation/ walkways			
9	The internal circulation between the exit and the entrance is well linked, and allow safe and easy circulation of people and machinery.			
10	The lighting and electrical system allows safe environmental conditions in terms of lighting and electrical shock.			

11	The technology of power saving is respected.			
12	The installed drainage system for rainwater is efficient and doesn't affect the surrounding areas/ public infrastructure.			
13	The dumping area is appropriate and well managed. The used noise and dust protective/ mitigation measures are efficient to protect the surroundings.			
14	Suitable and enough fire-fighting equipment is in place and suitably located and secured.			

3. General Comments

4. Registered Construction and Supervision firms

Name of The Construction Firm: Registration / Licence Number:	Name of the Supervision Firm: Registration / Licence Number:
Site Engineer's Name: Contact details Cell phone: Email:	Site Engineer's Name: Contact details Cell phone: Email:
Date and Signature of the site Engineer	Date and Signature of the site Engineer

5. Building Consent Authority Inspectors

S/N	Names	Signature
1		
2		
3		
4		

Form 2: EXCAVATION AND EARTHWORKS

1. Site identification and Contractor details

Developer/ Owner's names:
Name of the project:
Project Location Province / City: District: Sector: Cell: Unique Parcel Identifier :
Number of floors:
Occupancy Classification Group: Class: Sub-group:
Contractor's details Contact name: Phone number: Email:

2. Detailed Inspection

SN	Description	Yes	No	Comments
1	The excavation, levelling, trenching, and embankment works comply with the approved plans.			
2	Excavation setback to lot line and adjacent buildings complies with the approved plans			
3	The transportation of debris is conducted avoid getting dirty of the site and surroundings.			
4	The requirements of safe-guard during excavation and earthworks are respected			
5	The dumping area is appropriate and well managed. The used noise and dust reduction/ mitigation measures are efficient to protect the surroundings.			

3. General Comments

4. Registered Construction and Supervision firms

Name of The Construction Firm: Registration / Licence Number:	Name of the Supervision Firm: Registration / Licence Number:
Site Engineer's Name: Contact details Cell phone: Email:	Site Engineer's Name: Contact details Cell phone: Email:
Date and Signature of the site Engineer	Date and Signature of the site Engineer

5. Building Consent Authority Inspectors

S/N	**Names**	**Signature**
1		
2		
3		
4		

Form 3: INSPECTION OF FOUNDATION WORKS

1. Site identification and Contractor details

Developer/ Owner's names:	
Name of the project:	
Project Location	
	Province / City:
	District:
	Sector:
	Cell:
	Unique Parcel Identifier:
Number of floors:	
Occupancy Classification	
	Group:
	Class:
	Sub-group:
Contractor's details	
	Contact name:
	Phone number:
	Email:

2. Detailed Inspection

SN	Description	Yes	No	Comments
1	The procedure and techniques used comply with the approved plans and all requirements described in the Rwanda National Building Code			
2	The soil treatment for insects is done and organic materials and debris in the areas have been removed prior to the application of chemicals.			
3	Erosion control measure are in place			
4	The footing/ Foundation size and location complies with the approved plans			
5	The size and placement of reinforcements complies with the approved plans			
6	Forming of footings and concrete placement complies with the approved drawings			
7	The required plumbing lines comply with the approved plans.			

3. General Comments

4. Registered Construction and Supervision firms

Name of The Construction Firm: Registration / Licence Number:	Name of the Supervision Firm: Registration / Licence Number:
Site Engineer's Name: Contact details Cell phone: Email:	Site Engineer's Name: Contact details Cell phone: Email:
Date and Signature of the site Engineer	Date and Signature of the site Engineer

5. Building Consent Authority Inspectors

S/N	**Names**	**Signature**
1		
2		
3		
4		

Form 4: INSPECTION OF SUPERSTRUCTURE WORK

3. Site identification and Contractor details

Developer/ Owner's names:	
Name of the project:	
Project Location	
	Province / City:
	District:
	Sector:
	Cell:
	Unique Parcel Identifier:
Number of floors:	
Occupancy Classification	
	Group:
	Class:
	Sub-group:
Contractor's details	
	Contact name:
	Phone number:
	Email:

4. Detailed Inspection

SN	Description	Yes	No	Comments
1	The executed structural works comply with approved plans.			
2	The size of the structural members complies with the approved plans			
3	The size and placement of reinforcements complies with the approved plans			
4	Forms installation and bracing, shoring, plumbing and cross bracing, concrete placement, curing period and procedure were suitably executed			
5	The executed structural works/truss of the roof complies with approved plans and all roof members are assembled and tightened accordingly			
6	For other works including mechanical, electrical, plumbing and information technology have no defects on the completed or ongoing works and the electrification is done using power saving technology.			

5. General Comments

6. Registered Construction and Supervision firms

Name of The Construction Firm: Registration / Licence Number:	Name of the Supervision Firm: Registration / Licence Number:
Site Engineer's Name: Contact details Cell phone: Email:	Site Engineer's Name: Contact details Cell phone: Email:
Date and Signature of the site Engineer	Date and Signature of the site Engineer

7. Building Consent Authority Inspectors

S/N	**Names**	**Signature**
1		
2		
3		
4		

Form 5: JOINT SITE INSPECTION

1. Building identification and Contractor's details

Developer/ Owner's names:	
Name of the project:	
Project Location	
	Province / City:
	District:
	Sector:
	Cell:
	Unique Parcel Identifier:
Building capacity	
	Number of floors:
	Number of users:
	Parking capacity (number):
	Green area (estimated percentage):
	Built area (estimated percentage):
Building status	
	☐ Completed building
	☐ Occupied building
	☐ Abandoned site
	☐ Suspended site
	☐ Collapsed building
Occupancy Classification	
	Group:
	Class:
	Sub-group:
Contractor's details	
	Contact name:
	Phone number:
	Email:

2. Inspection of the Building

	Item	Physical Description (Used Materials, Techniques, Machinery, etc.)	Observations (noncompliance/ defect)
		I. General Works	
1.1	Site Installation		
1.2	Site fencing and boundary demarcation		
1.3	Earth works		
1.4	Excavation		
1.5	Leveling		
1.6	Compaction		
1.7	Embankment		
1.8	Trenching		

1.9	Dumping Areas		
1.10	Transportation		
		II. Foundation Works	
2.1	Foundation size		
2.2	Used material		
2.3	Damp-proof course		
2.4	Soil treatment for insects		
2.5	Rough plumbing		
2.6	General safety		
		III. Structural Works	
3.1	Scaffoldings		
3.2	Elevation works		
3.3	Roof structure		
		IV. Framing	
4.1	Walls		
4.2	Roofs		
4.3	Shingles		
4.4	Doors		
4.5	Windows		
4.6	Stairs		
		V. Fire safety	
5.1	Fire extinguishers		
5.2	Smoke detectors		
5.3	Sprinklers		
5.4	Water hydrants		
5.5	Fire alarms		
5.6	Hose reel		
5.7	Emergency evacuation plan		
5.8	Assembly point (where applicable)		
		VI. Security	
6.1	Security control room		
6.2	CCTV camera		
6.3	Walk through		
6.4	Luggage scanner		
6.5	Hand held metal detectors		
6.6	Security staff		
6.7	Landing space for helicopter (where applicable)		
6.8	Required building Signage		
		VII. Other works	
7.1	Electrical installations		
7.2	Plumbing installations		
7.3	IT Facilities		
7.4	Fire safety measures		
7.5	Security facilities		
7.6	Accessibility		
		VIII.Finishes	
8.1	Interior finishes Used material		
8.2	Used procedures, methods, techniques		

8.3	Exterior finishes		
8.4	Used material		
8.5	Used procedures, methods, techniques		
IX. Landscaping			
9.1	Zoning		
9.2	Parking		
9.3	Garden		
9.4	Walk ways		
9.5	Lighting		
9.6	Splash Aprons		
X. Demolition			
10.1	Safety measures		
10.2	Workers		
10.3	Sealing services		
10.4	Used Machinery and tools		
10.5	Dumping area		
10.6	Salvage		
10.7	Transportation		

3. General Comments

4. Registered Construction and Supervision firms

Name of The Construction Firm: Registration / Licence Number:	Name of the Supervision Firm: Registration / Licence Number:
Site Engineer's Name: Contact details Cell phone: Email:	Site Engineer's Name: Contact details Cell phone: Email:
Date and Signature of the site Engineer	Date and Signature of the site Engineer

5. Building Consent Authority Inspectors

S/N	Names	Signature
1		
2		
3		
4		

Form 6: BUILDING SETTING OUT SELF CERTIFICATION FORM

DATE

Recuperation date: ……..… Submission Date ……..……..…

DEVELOPER IDENTIFICATION

Developer/ Owner's names:
Name of the project:
Contractor's Contact name
District:
Sector:
Cell:
Plot Number :
Contractor's phone number:
Contractor's Email
Project usage:
Number of floors:
Occupancy Classification Group: Class: Sub group: Type:

MANDATORY CONDITIONS FOR SETTING OUT A BUILDING

i. During the setting out, the following is mandatory to be respected (YES means Respected and NO means not respected):

- Road reserve (if any) Yes No
- Approved setbacks Yes No
- Building coverage as required Yes No
- Building layout (footprint) Yes No
- If NOT why?

.....

ii. Setting out must be carried out by a Certified Construction company represented by a registered / licensed Engineer

iii. Setting out must be approved and confirmed by a certified supervision company represented by a registered Engineer/ Architect

BUILDING SETBACKS DIMENSIONS

	Setbacks according to the Master plan	Approved drawing setbacks	Measured to site setbacks (Setbacks after setting out)
Front setback (in meters)			
Rear setback (in meters)			
Left side setback (in meters)			
Right side setback (in meters)			

GENERAL SITE PLAN LAYOUT (Architect sketch showing the setbacks dimensions on all sides, road reserve and the position of the building in the whole site referring to approved site plan)

CERTIFICATION

- **Supervision consultancy**

I certify that the information in this application relating to the setting out, as indicated in the table and sketch here in attached, are true and correct to the best of my knowledge. I further declare that the mentioned setbacks are in conformity with approved site plan. I understand that any false or misleading information may result in demolition of the non-approved building components of which I will be responsible, or subsequent punitive measures applied by law to a professional architect (or Engineer) in Rwanda.

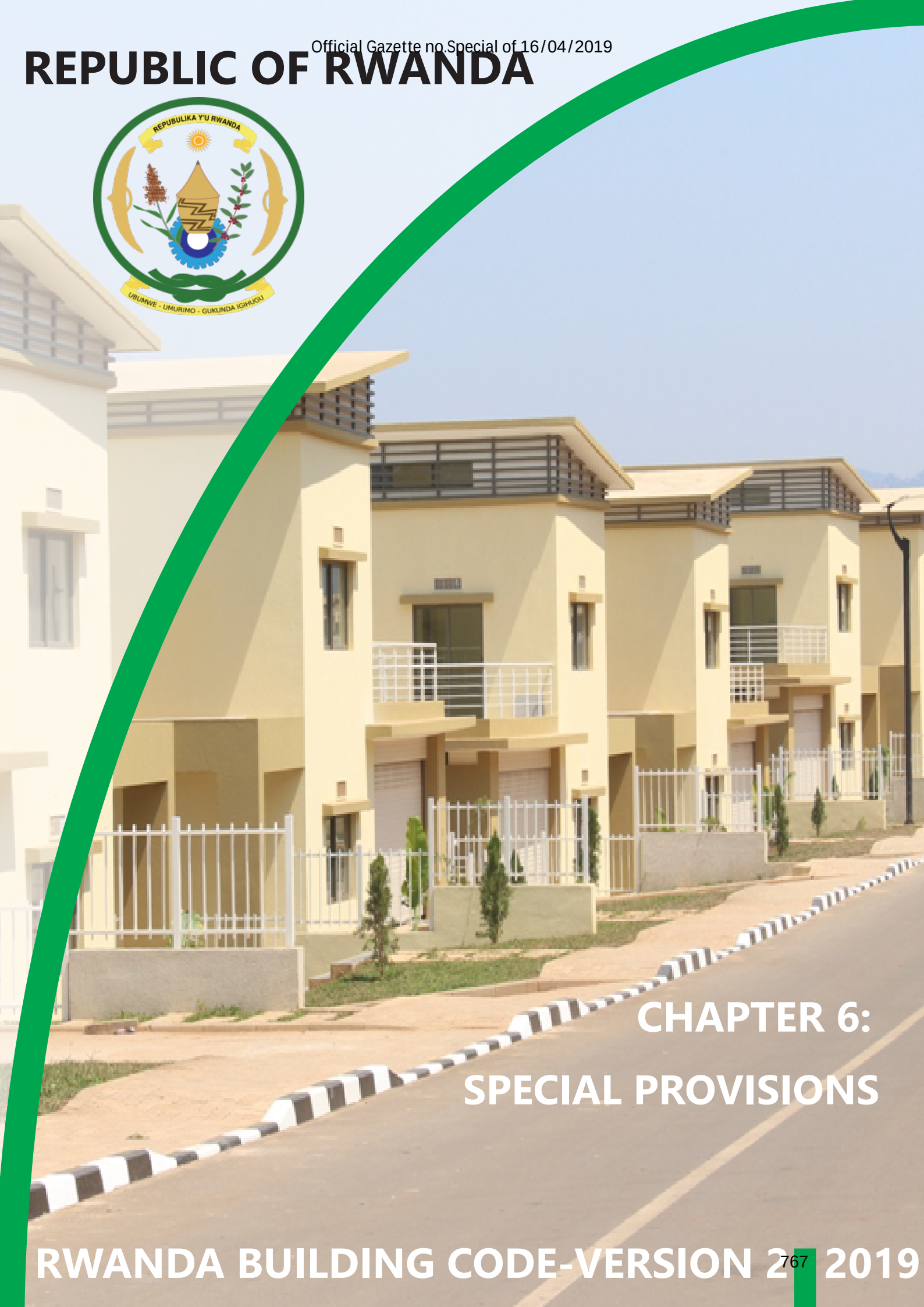
Signature and Name of professional and Stamp	Name and Address of Professional Firm and Stamp (if any)

- **Contractor**

I certify that the information in this application relating to the setting out, as indicated in the table and sketch here in attached, are true and correct to the best of my knowledge. I further declare that the mentioned setbacks are in conformity with approved site plan. I understand that any false or misleading information may result in demolition of the non-approved building components of which I will be responsible, or subsequent punitive measures applied by law to a professional Engineer in Rwanda.

Signature and Name of professional and Stamp	Name and Address of Professional Firm and Stamp (if any)

REPUBLIC OF RWANDA



CHAPTER 6:
SPECIAL PROVISIONS

RWANDA BUILDING CODE

Chapter Six:
SPECIAL PROVISIONS

PART 15: SPECIAL CONDITIONS & PROVISIONS

SECTION 1: RISK ZONING & REGIONAL CONSIDERATIONS
SECTION 2: GREEN CONSTRUCTION PRACTICES
SECTION 3: INCENTIVES FOR GREEN BUILDINGS.
SECTION 4: LOCAL MATERIALS & CONSTRUCTION TECHNIQUES
SECTION 5: IMIDUGUDU (GROUPED SETTLEMENTS) CONSIDERATIONS
SECTION 6: INCREMENTAL BUILDING.
SECTION 7: HISTORICAL BUILDINGS, MEMORIAL & BURIAL SITES

CONTENTS

PART 15 SPECIAL CONDITIONS & CONSTRUCTIONS

SECTION 1: RISK ZONING & REGIONAL CONSIDERATIONS

6.15.1.1. RISK ZONING

6.15.1.1.1. The identification of the risk zones and the determination of risk levels and parameters for them shall be the most complex and crucial part in the risk mitigation work, because this determines the trustworthiness of all subsequent developments.

6.15.1.2. Risk Zoning maps are those that identify the risk areas that shall guide the designers and other stakeholders in the planning and implementation of the different development plans that include buildings and other infrastructure development projects. Detailed Sub Area Plans are detailed physical plans for specific areas are also available prepared to guide their development. The reference risk zoning map for this Code shall be as in Figure 6.15.1-1 and shall be continuously updated and detailed sub area maps shall be requested from the Building Control Authority when required.

6.15.1.3. Notwithstanding the need for such development as in sub-regulation 6.15.1.2, no person shall develop or cause to be developed any building on land identified as a risk zone and where development permission that takes into consideration risk mitigation measures applicable to the area and type of risk shall not be granted.

6.15.1.4. Granting building permits in areas identified as risk zones shall in addition to compliance with sub-regulations 1.5.1.1, and 1.5.1.2 of this Code (issuing building permits), shall also comply with the provisions of this section.

6.15.1.5. In the event that the applicant has an alternative solution or approach other than that provided in this section; the request for approval to use an alternative means of mitigation or risk containment shall be made in writing to the Authority by the owner or the authorized representative. The request shall be accompanied by a enough evidence that the proposed alternate mean provides reasonable protection to occupants, he/she shall explain plan and processes related to warnings,

evacuations routes and other pertinent conditions relative to the viability of the proposed incase of anticipated negative outcomes.

6.15.1.6. All other conditions of this Code apply to risk zones except where specifically stated.

6.15.1.7. LIGHTNING AND FLOODS PRONE ZONES

6.15.1.7.1. Protection against lightning: in lightning prone areas all building shall comply with the requirements of regulation 4.11.3.5.3.2 governing protection against lightening. In addition, inclusion of lightning protection devices shall be compulsory for all building of the following classes: A, E, I, R-1, R-3, S-1 and all other places where it is deemed necessary for safety of occupants.

6.15.1.7.2. Construction of buildings shall be discouraged in flood prone zones and wetlands as far as possible. When construction cannot be prohibited, suitable and sufficient measures shall be taken to ensure, as far as reasonably practicable, the life ecosystem in the wetlands is not affected.

6.15.1.7.3. The flood risk zones are derived from the analysis of frequencies of daily rainfall exceeding 50mm, which are located as indicated on the risk zone map. These maps are not exhaustive and further information may be required.

6.15.1.7.4. The Authority shall also have adopted a recent flood report and map for an area not included in the regulations.

6.15.1.7.5. Authority in charge of urban planning and human settlement shall indicate which areas are flood prone.

6.15.1.7.6. Authority shall have local knowledge of when flooding occurred in the past. It may also be necessary ask neighbors or people who live in the area.

6.15.1.7.7. Local media, researchers and communities shall have access to previous flood records. Insurance companies that conduct business in the area shall also have information.

6.15.1.7.8. The technical requirements for building in an area that is subject to flooding is that the floor level of any habitable room shall be 300mm or more above the designated flood level for that land. The 'designated flood level' is the flood level that has a low probability of being exceeded in any one year (for a watercourse flood plain mapped or reported) or 600mm above ground level or the highest known flood level (for those areas not mapped).

6.15.1.7.9. Basic design requirements apply to flood hazards areas that are not prone to landslide, mudslide, or storm surge; and where the maximum flow velocity is not greater than 1.5m/s.

6.15.1.7.10. Different action shall be applied during the design of structures exposed to floods. The flood actions shall include, but not limited to, the following as appropriate:

(i) The flood actions shall be based on the Defined Flood Event (DFE);

(ii) Hydrostatic actions caused by a depth of water to a Defined Flood Level (DFL).

(iii) Hydrodynamic Actions:

a. Dynamic effects of moving water;

b. Where water velocities do not exceed 1.5m/s, the hydrodynamic actions can be approximated into equivalent hydrostatic actions by increasing the DFL by an equivalent surcharge depth for slow moving water (flow velocity less than 3m/s) and building aspect ratio (width to height) less than 12. For situations outside these limits, a full engineering analysis shall be carried out.

(iv) Impact of debris actions caused by objects transported by flood waters striking against buildings and structures shall be determined using engineering principles as concentrated loads acting horizontally at the most critical location at or below the DFL;

(v) Wave actions caused by water waves propagating over the water and striking a building or other structure shall be determined using engineering principles. Wave actions include wash and wind generated waves;

(vi) The effects of erosion and scour shall be included in the calculation of actions on building foundations and other structures in flood hazard areas;

(vii) Floor Height Requirements: Unless otherwise specified by the appropriate authority:

a. The finished floor level of habitable rooms shall be above the FHL; and

b. The finished floor level of enclosed non-habitable rooms shall be no more than 1.0 m below the DFL Where FHL and DFL shall mean; [Flood hazard level (FHL): the flood level used to determine the height of floors in a building and represents the defined flood level (DFL) plus the freeboard. Freeboard: the height above the defined flood level (DFL) as determined by the Building Control Authority typically used to compensate for effects such as wave action and localized hydraulic behavior].

(viii) The footing system of a structure shall provide the required support to prevent flotation, collapse or significant permanent movement resulting from the flood actions as specified;

(ix) The footing system design shall account for instability and decrease in structural capacity associated with soil properties when wet, erosion and scour, liquefaction, and subsidence resulting from the flood actions specified above depending on the geotechnical characteristics of the site;

(x) The footing system depth must be adequate to provide the support required in taking into account the geotechnical considerations;

(xi) Piers, posts, columns and piles used to elevate buildings to the required elevation shall take account of the potential erosion action due to flood; and the potential debris actions;

(xii) Fill providing support to the footing system shall be designed to maintain that support under conditions of flooding, including rapid rise and draw-down of flood waters, prolonged inundation erosion and scour, without exceeding the maximum design specifications.

(xiii) Use of Slabs:

a. Slabs shall be installed on fill in accordance with 2.6.4, or on undisturbed soil of adequate bearing capacity and have adequate strength to resist the design actions even if the supporting soil under the slab is undermined by erosion; and
b. The bottom of the slab edge (usually the edge beam or edge footing) shall be at or below the depth of expected scour.

(xiv) Requirements for Enclosures Below the Flood Hazard Level (FHL)

a. Any enclosure below the FHL shall have openings to allow for automatic entry and exit of floodwater for all floods up to the FHL.
b. The openings shall meet the following criteria:
    1. Doors and windows shall not be counted as openings but openings can be installed in doors and windows;
    2. There shall be a minimum of two openings on different sides of each enclosed area;
    3. The total net area of all openings shall be at least 1% of the enclosed area; and
    4. Openings shall permit a 75mm sphere to pass through; and
    5. Any opening covers shall not impede the flow of water.

(xv) Requirements for Structural Attachments

a. Erosion control structures that are attached to the foundation or superstructure of the building shall be structurally adequate and not reduce the structural capacity of the building during the DFE; and
b. Decks, patios, stairways, ramps and the like below the FHL that are attached to the building shall be structurally adequate and not reduce the structural capacity of the building during the DFE.

(xvi) Material Requirements

a. Materials used for structural purposes and located below the FHL shall be capable of resisting damage, deterioration, corrosion or decay

taking into account the likely time the material would be in contact with flood water and the likely time it would take for the material to subsequently dry out; and

b. For the purposes of (a), materials used for structural purposes include load bearing columns, bracing members, structural connections, fasteners, wall framing members and the like.

(xvii) Requirements for Utilities

a. Utilities and related equipment, other than an electrical meter for the building, shall not be placed below the FHL unless they have been designed specifically to cope with flood water inundation. Note: The location of electrical meters is regulated by the Authority in charge of Electricity;
b. Buried systems shall be placed at a depth sufficient to prevent damage due to scour and erosion during the DFE; and
c. Exposed systems shall be designed to withstand the flood related actions (buoyancy, flow, debris and wave).

(xviii) Unless the electrical Institution determines otherwise:

a. Electrical switches shall be placed above the FHL; and
b. Electrical conduits and cables installed below the FHL shall be waterproofed or placed in waterproofed enclosures.

(xix) Mechanical and HVAC systems, tanks and the like: Ductwork, tanks, gas storage cylinders and the like shall be placed above the FHL or designed, constructed, installed and anchored to resist all flood-related actions and other actions during the DFE with appropriate load factors as given above. Potential buoyancy and other flood related actions on the empty tank during the DFE condition shall be considered;

(xx) Egress from a balcony, verandah, deck, door, window or the like shall be available to allow a person in the building to be rescued by emergency

services personnel, if rescue during a flood event up to the DFE is required.

6.15.1.8. WINDSTORMS PRONE ZONES

6.15.1.8.1. In area prone to strong wind, wind breakers (Trees) must be used to reduce the wind velocity.

6.15.1.8.2. Houses located in areas prone to strong winds shall have a reinforced correspondingly.

6.15.1.8.3. Roof structure should be placed such that it faces the opposite direction of the wind. In case this is not possible, the roof should be hidden behind a parapet wall.

6.15.1.8.4. In case the building has been reinforced, walls must be tied into the building structure using metal hooks or reinforcement bars placed at minimum intervals of 60cm so that they cannot move separately when the force of nature impact them.

6.15.1.9. EARTHQUAKES

6.15.1.9.1. All buildings and structures in earthquake zones shall comply with all provisions of this Code especially Chapters 2 and 5. In addition the buildings shall be guided by the following principles guided by ISO 3010 for design values and criteria where relevant. In particular:

(i) Protection against earthquakes shall be in accordance in such a manner to withstand all seismic forces to the extent to avoid structure failure, losses of lives and property 2 as specified in Part 6 of this Code;

(ii) Suitable materials satisfying the conditions as set out in Part 7 of this Code shall be used without compromising the requirements of high seismic areas in Rwanda; and

(iii) Repair and seismic strengthening, retrofitting of existing buildings shall be undertaken using suitable materials in order to avoid loss of lives and damage to properties.

6.15.1.9.2. This Code requires a two level seismic design requirement:

(i) The structure shall be designed and constructed to withstand the design seismic action without local or global collapse, thus retaining its structural integrity and a residual load bearing capacity after the seismic event; and

(ii) The structure shall be designed and constructed to withstand a seismic action having a larger probability of occurrence than the design seismic action, without the occurrence of damage and the associated limitations of use, the costs of which would be disproportionately high in comparison with the costs of the structure itself.

6.15.1.9.2.1. The first requirement is related to the protection of life under a rare event, through the prevention of the global or local collapse of the structure that, after the event, shall retain its integrity and a sufficient residual load bearing capacity. After the event the structure may present substantial damages, including permanent drifts, to the point that it may be economically unrecoverable, but it shall be able to protect human life in the evacuation process or during aftershocks. In the framework of this Code the design shall use the concept of Limit States; this performance requirement is associated with the Ultimate Limit State that deals with the safety of people or the whole structure.

6.15.1.9.2.2. The second requirement is related to the reduction of economic losses, both in what concerns structural and non-structural damages. Under an earthquake events, the structure shall not have permanent deformations and its elements should retain its original strength and shall consider performance requirements of; ground conditions and seismic action and stiffness in view of the minimization of non structural damage the structure shall have adequate stiffness to limit, under such frequent events, its deformation to levels that do not cause important damage on such elements.

6.15.1.9.3. DESIGN AND CONSTRUCTION FEATURES IMPORTANT TO SEISMIC PERFORMANCE

To satisfy the fundamental requirements of this Code a number of characteristics are important to the design of buildings and structures to ensure that they will behave adequately in strong earthquakes. This Code provisions requires inclusion

of all of these features in the design and construction of buildings and other structures.

6.15.1.9.3.1. In addition to being able to support a structure's weight without excessive settlement, the stable foundation system shall be able to resist earthquake-induced overturning forces and be capable of transferring large lateral forces between the structure and the ground. Foundation systems also shall be capable of resisting both transient and permanent ground deformations without inducing excessively large displacements in the supported structures. On sites that are subject to liquefaction or lateral spreading, it is important to provide vertical bearing support for the foundations beneath the liquefiable layers of soil. This often will require deep foundations with drilled shafts or driven piles. Because surface soils can undergo large lateral displacements during strong ground shaking, it is important to tie together the individual foundation elements supporting a structure so that the structure is not torn apart by the differential ground displacements. A continuous mat is an effective foundation system to resist such displacements. When individual pier or spread footing foundations are used, reinforced concrete grade beams between the individual foundations shall be provided so that the foundations move as an integral unit.

6.15.1.9.3.2. All parts of a building or structure, including non-structural components, shall be tied together to provide a continuous path that will transfer the inertial forces resulting from ground shaking from the point of origination to the ground.

6.15.1.9.3.3. The structure of any building shall resist vibration, vertical and lateral forces that are generated by earthquake. Strong earthquake bracing and dumping shall be provided.

6.15.1.9.3.4. Regular and irregular structures shall be considered for mass distribution, strength, and stiffness to achieve uniformity in case of ground shaking.

6.15.1.9.3.5. The structural elements shall be designed to provide sufficient strength to support anticipated dynamic loads without failure so that they will not deflect excessively under these loads.

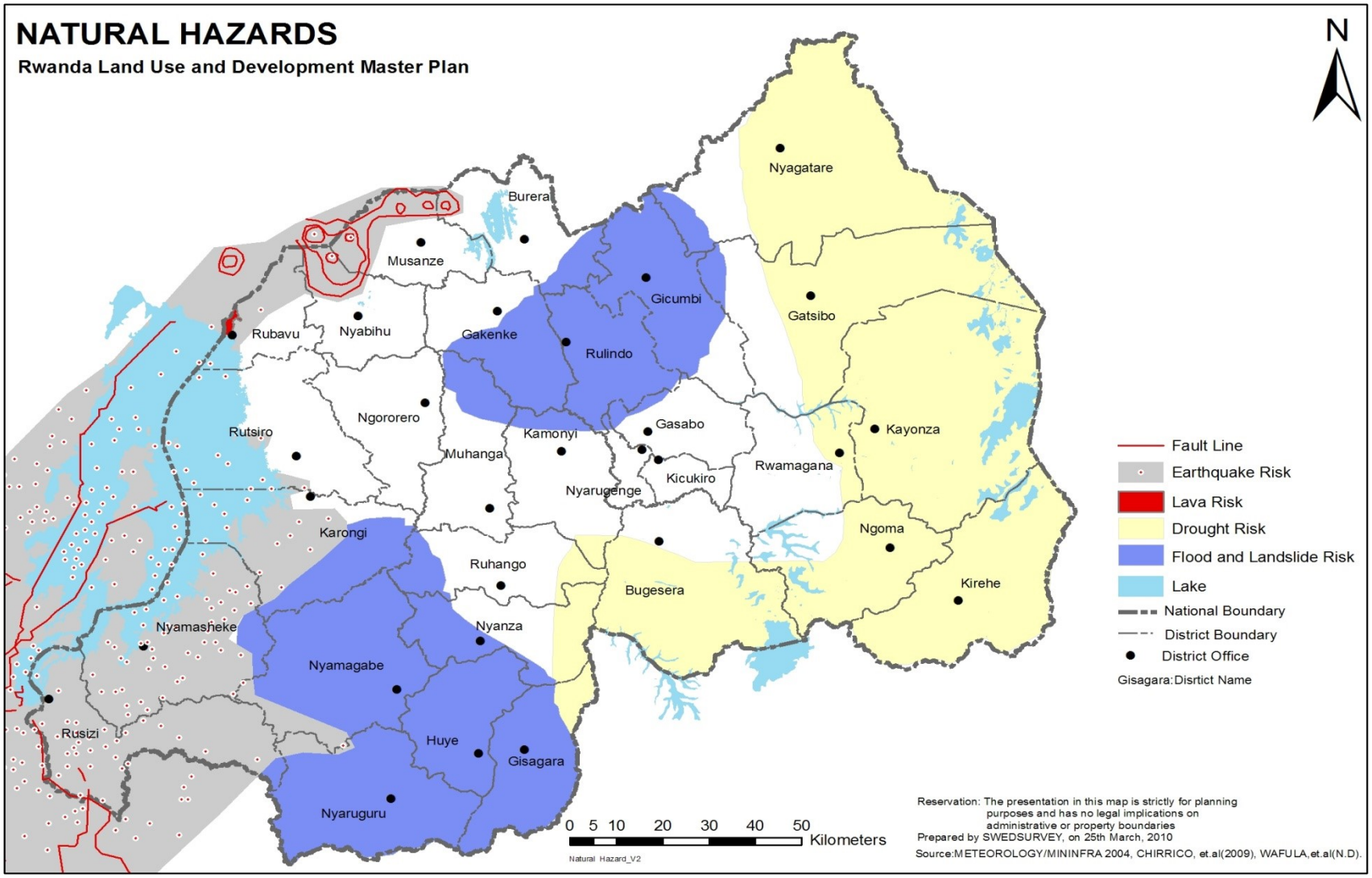


Figure 6.15.1-1 Natural Hazards in Rwanda (Source: RNRA 2014**)**

SECTION 2: GREEN CONSTRUCTION PRACTICES

Green building (also known as green construction or sustainable building) refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle.

6.15.2.1. The green building minimum compliance system shall apply to:

(i) All new Category 4 & 5 buildings; Additions, extensions, and refurbishment of existing buildings which require a building permit, notably for the following building typologies:

1. Commercial buildings (excluding warehouses and retail shops)
2. Public administrative and institutional buildings (excluding correctional services, police, fire department)
3. Social, cultural and assembly buildings
4. Health facilities
5. Educational buildings (excluding living areas for students)

(ii) Existing buildings, when specified;

(iii) Mixed Use Buildings: When a building combines more than one use, each portion of the building shall comply with the relevant regulations for that particular typology; and

(iv) Change of Use: When there is a change of use for a building; these regulations apply for the new use, when specified;

6.15.2.2. The regulations are supported by a document titled "Rwanda Green Building Minimum Compliance System."

(i) The Green Building Minimum Compliance System has been developed to provide understanding of the reason for the regulations, green building minimum compliance indicators, their benefits and guidance towards compliance; and

(ii) The Green Building Minimum Compliance System is not intended to provide detailed design information or to be a substitute for the experience and expertise of building designers and contractors.

SECTION 3: INCENTIVES FOR GREEN BUILDING

6.15.3.1. Incentives for green building shall be in line with the National Housing Policy, and the scope of the green building program desired.The following is a list of the incentives that may be offered.

(i) Tax Incentives;
(ii) Bonus Density;
(iii) Expedited Permitting;
(iv) Net Metering;
(v) Grants (including fee subsidization);
(vi) Loans;
(vii) Technical Assistance/Design Assistance;
(viii) Permit/Zone Fee Reduction;
(ix) Rebates and Discounts on Environmental Products (e.g., Energy Star); and
(x) Leasing Assistance.

6.15.3.1.1. Tax Incentives may be offered in any of the following:

(i) Corporate Tax (tax levied on companies or associations;
(ii) Gross Receipts Tax (tax levied on the total gross revenues of a company – charged to the seller of goods);
(iii) Income Tax (tax levied on persons, corporations, or other legal entities);
(iv) Property Tax/Ad Valorem Tax (tax levied on the value of property);
(v) Sales Tax (tax levied on goods and services – charged at the point of purchase); and
(vi) Local Tax (tax levied from districts).

6.15.3.1.2. Bonus Density: This shall include height bonuses, floor area ratio (FAR) bonuses, reductions in landscaping requirements and the counting of green roof space as landscaping/open space in return for achieving levels of green building ratings.

6.15.3.1.3. Expedited Permitting: This involves streamlining the permitting process for building plan, and site permits to save green developers substantial time and money.

6.15.3.1.4. Net Metering: This is to allow consumers who own renewable energy facilities, such as wind or solar power instruments, to generate their own power/energy and be able to sell excess power back to the community. This process can develop clean energy as an industry, much like cell towers, and buildings could potentially sell space for photovoltaic to companies. Installing photovoltaic arrays on big box retail buildings could generate substantial amounts of electricity and entice developers and owners to build not only energy efficient, but energy producing buildings.

6.15.3.1.5. Grants (including fee subsidization): This is a consideration that building owners can enter into a grant programs, which can offset some of the increased development costs that arise from a green building project. Grants can include programs such as tax abatements.

6.15.3.1.6. A loan fund shall be established to be used specifically for green improvements. This can use performance contracting to provide loans at reduced interest rates to developers that agree to build to specified green standards.

6.15.3.1.7. Technical Assistance/Design Assistance: This is provision of free consultancy to developers. [Demand for sustainable design is increasing rapidly but even in the development community there are still questions over exactly what kind of green design techniques are most effective and in demand. It is important for government to provide quality service to the development and design community by training planners, building inspectors, and other local officials, as these are the main points of contact between the jurisdiction and private building interests. Well-trained local officials can also educate the community at large and promote voluntary efforts. Jurisdictions can even earn revenue by offering consulting on green building projects. This fosters a culture of sustainable design throughout the community and in the long term, this can be much more effective than formal legislation and regulations. Often, developers with a short-term investment outlook have less incentive to build more efficient structures because they will not occupy buildings in long term. Therefore, these developers will generally not see the returns from greater efficiency and lower utility costs. A reduction in the

initial building construction fees will affect these developers most dramatically. Jurisdictions shall weigh long-term versus short-term considerations carefully. The hoped for result is that rebates grow exponentially as green building proliferates, so governments shall prepare for increased usage to make sure these programs are sustainable. This strategy can ultimately be one that is effective and highly beneficial.

6.15.3.1.8. Permit/Zone Fee Reduction: This option is almost exclusively for use by cities rather than at country level. Specific levels green rating systems such as LEED, several jurisdictions waive or partially reimburse the application, building, or permit fees charged. This directly affects the party funding the construction of a building, so it can be a particularly attractive incentive. Often, developers with a short-term investment outlook have less incentive to build more efficient structures because they will not occupy buildings long term. Therefore, these developers will generally not see the returns from greater efficiency and lower utility costs. A reduction in the initial building construction fees will affect these developers most dramatically. Jurisdictions shall weigh long-term versus short-term considerations carefully. The hoped for result is that rebates grow exponentially as green building proliferates, so municipalities shall prepare for increased usage to make sure these programs are sustainable.

6.15.3.1.9. Rebates and Discounts on Environmental Products: Discounts on environmental products are an option that may require initial investment but will pay for itself in the long term. Municipalities can purchase energy efficient appliances in bulk and offer discounted prices, passing the savings on to citizens who buy these items from the city. Some jurisdictions offer other financing assistance and often provide “preferred lists” of appliances. Alternatively, a city can simply provide a rebate, which is easier to administer. These programs can work at any level of government and have the advantage of being highly targeted. Jurisdictions especially concerned with water conservation or energy use can directly affect efficiency and target the rebates appropriately.

6.15.3.1.10. Leasing Assistance: Jurisdictions can lease energy efficient equipment to businesses and residents so that the initial cost of purchasing and/or installing the equipment is passed on to the state or local government. Since a city or state has significant purchasing power, it can pass the savings of buying in bulk on to citizens by leasing this equipment. In doing so, it is making energy efficiency attainable in instances where it might not be affordable otherwise. By providing this assistance, cities and states may have to make an initial investment of funds but generally will make most of the money back from payments on the equipment.

SECTION 4: LOCAL MATERIALS & CONSTRUCTION TECHNIQUES

6.15.4.1. The use of local materials available on or near the site for construction including stone and granite, mud or clay stabilized with rice straw, corral ash and/or cement dust to improve resistance to erosion and structural properties shall be encouraged.

6.15.4.2. New material designs (mixes) and techniques that will have been approved by relevant authorities coupled with the revival (sometimes modified) traditional building techniques and training of youth in producing and building with these materials shall give communities more independence in constructing their own homes and make these houses more affordable. At minimum, they shall save transport of material costs, and the overhead of a contractor.

6.15.4.3. The design and use of materials in National Housing Policy shall ensure that future maintenance and running costs are low, as these contribute towards the overall affordability of dwellings.

6.15.4.4. The design of houses shall be cost effective to be afforded by low- and middle-income earners. This affordability shall be achieved by using locally produced building materials. The Government may provide subsidies toward reduction of construction costs.

SECTION 5 UMUDUGUDU (GROUPED SETTLEMENT) CONSIDERATIONS

6.15.5.1. Local population shall be consulted for the location or site to build Umudugudu. District councils approve the suggested sites before implementation both in urban and rural areas. Social services, work places and farm lands shall induce the selection of Umudugudu site. (In urban areas umudugudu shall respect the urban planning documents).

6.15.5.2. Before or after any Umudugudu development, the chosen site shall be serviced with basic infrastructures such as access road, water supply, sewerage network, fiber optic network, electricity, etc for green field areas.

6.15.5.3. Efficient use of land shall be ensured and based on appropriate land use. This shall include but not limited to detached and high-rise dwellings.

SECTION 6 INCREMENTAL BUILDING

6.15.6.1. GENERAL REQUIREMENTS

6.15.6.1.1. The building permitting and approvals of incremental buildings shall abide by the provisions of this Code as elaborated in Part 3.

6.15.6.1.2. Every stage of construction shall require the owner to notify the Building Consent Authority to allow resumption of works. In case the permit is expired, the owner shall in addition to the above notification requirements, be required to apply for renewal of a permit as applicable in this Code.

6.15.6.1.3. Modalities for second and subsequent construction permit application renewal shall be in accordance with conditions and procedure for application and issuance of building permits.

6.15.6.1.4. The design and construction of any incremental building shall comply with the design and construction of any component of the entire building at its completion.

6.15.6.1.5. Any incremental house shall be in conformity of this Code at any intermediate stage of erection be deemed to be a temporary building.

6.15.6.1.6. The ability to accommodate change shall be anticipated, structured and integrated into design and construction document and construction permits.

6.15.6.1.7. In the case of an incremental building there shall be Occupancy Permit which shall be provided on each phase of the building delivered by the Authority after the qualified Engineer and Architect have approved the finished component of the building, satisfy the requirements as per the construction permit.

6.15.6.2. GENERAL DESIGN REQUIREMENTS

6.15.6.2.1. The design of any incremental building shall be done as the design of the whole building and not only for one stage of construction. All structures shall be designed as required in Chapter 2 of this Code.

6.15.6.2.2. The applicant/designer shall state from the early stages of design how building will be constructed if they wish to accommodate any incremental change in any meaningful way. There shall be prepared an implementation plan stating how the increments will be done.

6.15.6.2.3. The size, material, proportion and position of doors and windows shall correspond or complement the prior approved plans.

6.15.6.2.4. The excavation of incremental building shall satisfy the requirements of this Code and shall be in a manner as to accommodate any vertical and horizontal increment until the entire building is completed.

6.15.6.2.5. Foundation shall be able to support the forces or loads of additional levels of the entire building and shall be designed, taking into account the entire building instead of one stage or any intermediate stage of construction. The design of foundation shall be as stated in Part 6 of this Code.

6.15.6.2.6. Columns shall be capable of sustaining and transmitting the dead load, imposed loads and the horizontal or inclined forces to which it shall be subjected, without exceeding the appropriate limits of stress for the materials of which it is constructed without excessive deformation. The columns and beams shall be designed to accommodate the incremental changes and shall not permit the passage of moisture from the outside to the inner surface of any storey of the building, or to any part of the building. The detailed design of columns and beams shall be as indicated in Part 6.

6.15.6.2.7. The design of slabs for an incremental building shall comply with the provisions of part 6 of this Code and shall be so designed to accommodate incremental changes.

6.15.6.2.8. Any wall of previous floors shall be capable to safely sustain any loads to which it is expected to be subjected and in the case of any structural wall such wall shall be capable of safely transferring such loads to the foundations supporting such wall until the construction of the last floor. Walls for incremental building or any wall shall be so constructed that it will adequately resist the

penetration of water into any part of the building where it would be detrimental to the health of occupants or to the durability of such building.

6.15.6.2.8.1. In places with extreme lateral loading, walls not carrying vertical loads, tertiary in the order of permanence, shall be needed to carry lateral loads. This does not mean they cannot be altered, but after any transformation, the capacity of the altered structure to resist lateral loading shall be reassessed.

6.15.6.2.8.2. Walls for incremental buildings shall be designed with reference and shall comply with the requirements stated in Part 6 Section 5.

6.15.6.2.9. Floors of Incremental building shall be designed so that they are capable to safely sustain any loads to which it is expected to be subjected until the construction of the last floor. Upper floors may differ in terms of size to the previous floor. Floors shall be designed and constructed so that they will adequately resist the penetration of water. They will satisfy the requirement in Part 6 Section 4.

6.15.6.2.10. The floors or slabs shall serve as an intermediate roof and proper roof shall be constructed at the last floor. Roof structures shall be designed with reference to Part 6 section7. Structural roof covering shall be designed in accordance with the general provisions of this Code.

6.15.6.2.11. Any material used in the erection of a building shall be of a quality adequate for the purpose for which it is to be used. Requirements of building materials and components and criteria for accepting new or alternative building materials and components are specified in Part 7 and the Building Consent Authority shall have the right to test or to have tested any material or component used or to be used in any building operations in order to determine whether the material or component complies with the requirements of this Code.

6.15.6.2.12. During construction of components of an incremental building, safety shall be taken into account from the initial construction up to the last increment.

SECTION 7: HISTORICAL BUILDINGS, MEMORIAL & BURIAL SITES

6.15.7.1. HISTORICAL BUILDINGS

The purpose of this section is to provide regulations for the construction, preservation, restoration, rehabilitation, relocation or reconstruction of buildings or properties designated as qualified historical buildings or properties. It is intended to provide solutions for the preservation of qualified historical buildings or properties, to promote sustainability, to provide access for persons with disabilities, to provide a cost-effective approach to preservation and to provide for the reasonable safety of the occupants or users. This Code acknowledges and accepts solutions that are reasonably equivalent to the regular Code when dealing with qualified historical buildings or properties.

6.15.7.1.1. It shall be noted that all buildings in Rwanda are subject to this Code including historical buildings, memorial and burial sites but, however, this does not preclude the necessity for these buildings to comply with other forms of legislation.

6.15.7.1.2. While the purpose is to preserve the character of places and town scapes which are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or which contributes to the appreciation of protected structures.

6.15.7.1.3. When a proposed design, material or method of construction and repair is being considered, the Building Consent Authority may seek the advice of other appropriate private or public boards, individuals or state or local agencies or other parties and shall, after considering all of the facts presented, including any recommendation of other appropriate boards, agencies or other parties determine if, for the purpose intended, the proposal is reasonably equivalent to that allowed by these regulations and it shall transmit such findings and its decision to the Authority for its application.

6.15.7.1.4. Where an emergency is declared and a qualified historical building or property is declared an imminent threat to life and safety, the Authority assessing such a

threat shall consult with the Building Control Authority before any demolition is undertaken.

6.15.7.1.5. Construction methods, repairs and materials

6.15.7.1.5.1. Repairs to any portion of a qualified historical building or property shall be made in-kind with historical materials and the use of original or existing historical methods of construction.

6.15.7.1.5.2. Only solutions provided in this Code or any other acceptable regulation or methodology of design or construction and used in whole or in part, within this Code shall be allowed. However this Code does not preclude the use of any proposed alternative or method of design or construction not specifically prescribed or otherwise allowed by these regulations. Any alternative shall be submitted for evaluation to the appropriate Authority for review and acceptance. The Authority may request that sufficient evidence or proof be submitted to substantiate any claims that may be made regarding such solutions. Any alternative offered in lieu of that prescribed or allowed shall have to be reasonably equivalent in quality, strength, effectiveness, durability and safety.

6.15.7.1.5.3. The use or character of occupancy of a qualified historical building or property, or portion thereof, shall be permitted to continue in use regardless of any period of time in which it may have remained unoccupied or in other uses, provided such building or property otherwise conform to all applicable requirements. The use or character of the occupancy of a qualified historical building or property may be changed from or returned to its historical use or character, provided the qualified historical building or property conforms to the requirements applicable to the new use or character of occupancy.

6.15.7.1.6. Existing provisions for light and ventilation which do not, in the opinion of the Authority, constitute a safety hazard may remain.

6.15.7.1.7. The intent of his provision is to preserve the integrity of qualified historical buildings or properties while maintaining a reasonable degree of fire protection based primarily on the life safety of the occupants and firefighting personnel.

6.15.7.1.8. The fire-resistance requirement for existing exterior walls and existing opening protection shall be satisfied when an automatic sprinkler system designed for exposure protection is installed. The automatic sprinklers shall be installed on the exterior with at least one sprinkler located over each opening required to be protected. Additional sprinklers shall also be distributed along combustible walls under the roof lines that do not meet the fire-resistive requirement due to relationship to property lines as required by this Code. Such sprinkler systems shall be connected to the domestic water supply on the supply-main side of the building shut-off valve.

6.15.7.1.9. Upgrading an existing qualified historical building or property to one-hour fire-resistive construction and one-hour fire-resistive corridors shall not be required regardless of construction or occupancy when one of the following is provided:

(i) An automatic sprinkler system throughout;
(ii) An approved life-safety evaluation; and
(iii) Other alternative measures as approved by the Building Consent Authority.

6.15.7.1.10. Every qualified historical building or property shall be provided with fire alarm systems as required for the use or occupancy by this Code or other approved alternative.

6.15.7.1.11. Existing or original roofing materials may be repaired or reconstructed provided that the original or historical roofing system shall be detailed or modified as necessary in order to be capable of providing shelter while preserving the historical materials and appearance of the roof.

6.15.7.1.12. Every qualified historical building or portion thereof shall be provided with exits as may be required. The Authority shall grant reasonable exceptions to the specific provisions of applicable egress regulations where such exceptions will not adversely affect life safety.

(i) Widths of less than dimensions required by regular Code shall be permitted where there is sufficient width and height for the occupants to pass through the opening or traverse the exit;

(ii) Existing stairs having risers and treads or width at variance with the regular Code are allowed if determined by the Building Consent Authority to not constitute a distinct hazard. Handrails with nonconforming grip size or extensions are allowed if determined by the Building Consent Authority to not constitute a distinct hazard;

(iii) The front or main entry doors need not be re-hung to swing in the direction of exit travel, provided other means or conditions of exiting, as necessary to serve the total occupant load, are provided;

(iv) Existing previously approved fire escapes and fire escape ladders shall be acceptable as one of the required means of egress, provided they extend to the ground and are easily negotiated, adequately signed and in good working order. Access shall be by an opening having a minimum width (737mm) when open; and

(v) The height of railings and guard railings and the spacing of balusters may continue in their historical height and spacing unless a distinct hazard has been identified or created by a change in use or occupancy.

6.15.7.1.13. The access for people with disabilities shall be applied to qualified historical buildings or properties unless strict compliance with the regular Code will threaten or destroy the historical significance or character-defining features of the building or property. These regulations require Authority to accept alternatives to regular Code when dealing with qualified historical buildings or properties.

6.15.7.1.14. If the historical significance or character-defining features are threatened, alternative provisions for access may be applied pursuant to this chapter, provided the following conditions are met:

(i) These provisions shall be applied only on an item-by-item or a case-by-case basis.

(ii) Documentation is provided, including meeting minutes or letters, stating the reasons for the application of the alternative provisions. Such documentation shall be retained in the permanent file of the Building Consent Authority.

6.15.7.1.15. Use of other designs and technologies or deviation from particular technical and scoping requirements are permitted if the application of the alternative provisions would threaten or destroy the historical significance or character-defining features of the historical building or property.

(i) Such alternatives shall be applied only on an item-by-item or a case-by-case basis;

(ii) Access provided by experiences, services, functions, materials and resources through methods including, but not limited to, maps, plans, videos, virtual reality and related equipment, at accessible levels. The alternative design and/or technologies used will provide substantially equivalent or greater accessibility to, and usability of, the facility; and

(iii) The official charged with the enforcement of the standards shall document the reasons for the application of the design and/or technologies and their effect on the historical significance or character-defining features. Such documentation shall include the opinion and comments of national accessibility officials, and the opinion and comments of representative local groups of people with disabilities. Such documentation shall be retained in the permanent file of the Building Consent Authority. Copies of the required documentation should be available at the facility upon request.

6.15.7.1.16. The purpose of this regulation is to provide alternative regulations for the structural safety of buildings designated as qualified historical buildings or properties. This provision requires Authority to accept any reasonably equivalent alternatives to the regular Code when dealing with qualified historical buildings or properties but the intent is to encourage the preservation of qualified historical

buildings or properties while providing a reasonable level of structural safety for occupants and the public at large.

6.15.7.1.16.1. The alternative structural regulations hereby provided are to be applied in conjunction with the regular Code whenever a structural upgrade or reconstruction is undertaken for qualified historical buildings or properties.

6.15.7.1.16.2. This provision shall not be construed to allow the Authority to approve or permit a lower level of safety of structural design and construction than that which is reasonably equivalent to the regular Code provisions in occupancies which are critical to the safety and welfare of the public at large, including, but not limited to, public and private schools, hospitals, municipal police and fire stations and essential services facilities. Nothing in these regulations shall prevent voluntary and partial seismic upgrades when it is demonstrated that such upgrades will improve life safety and when a full upgrade would not otherwise be required.

6.15.7.1.16.3. When a structure or portion of a structure is to be evaluated for structural capacity under this provision, it shall be surveyed for structural conditions by an architect or engineer knowledgeable in historical structures. The survey shall evaluate deterioration or signs of distress. The survey shall determine the details of the structural framing and the system for resistance of gravity and lateral loads. Details, reinforcement and anchorage of structural systems and veneers shall be determined and documented where these members are relied on for seismic resistance. The results of the survey shall be utilized for evaluating the structural capacity and for designing modifications to the structural system to reach compliance with this Code.

6.15.7.1.16.4. New non historical additions and non historical alterations which are structurally separated from an existing historical structure shall comply with regular Code requirements. New non-historical additions which impose vertical or lateral loads on an existing structure shall not be permitted unless the affected part of the supporting structure is evaluated and strengthened, if necessary, to meet regular Code requirements.

(i) The capacity of the structure to resist gravity loads shall be evaluated and the structure strengthened as necessary. The evaluation shall include all parts of the load path. Where no distress is evident and a complete load path is present, the structure may be assumed adequate by having withstood the test of time if anticipated dead and live loads will not exceed those historically present;

(ii) The ability of the structure to resist wind and seismic loads shall be evaluated. The evaluation shall be based on the requirements of structural design;

(iii) Any unsafe conditions in the lateral-load-resisting system shall be corrected or alternative resistance shall be provided. Additional resistance shall be provided to meet the minimum requirements of this Code; and

(iv) The architect or engineer shall consider additional measures with minimal loss of, and impact to historical materials which will reduce damage and needed repairs in future earthquakes to better preserve the historical structure in perpetuity.

6.15.7.1.16.5. The forces used to evaluate the structure for resistance to wind and seismic loads need not exceed 0.75 times the seismic forces. The seismic forces may be computed based on the values tabulated in the regular Code for similar lateral-force-resisting systems. All deviations of the detailing provisions of the lateral-force-resisting systems shall be evaluated for stability and the ability to maintain load-carrying capacity at increased lateral loads.

(i) The seismic resistance may be based upon the ultimate capacity of the structure to perform, giving due consideration to ductility and reserve strength of the lateral-force-resisting system and materials while maintaining a reasonable factor of safety. Broad judgment may be exercised regarding the strength and performance of materials not recognized by regular Code requirements;

(ii) All structural materials or members that do not comply with detailing and proportioning requirements of the regular Code shall be evaluated for potential seismic performance and the consequence of noncompliance. All

members which might fail and lead to possible collapse, or threaten life safety, when subjected to seismic demands in excess of those prescribed above shall be judged unacceptable, and appropriate structural strengthening shall be developed. Anchorages for veneers and decorative ornamentation shall be included in this evaluation;

(iii) A complete and continuous load path, including connections, from every part or portion of the structure to the ground shall be provided for the required forces. It shall be verified that the structure is adequately tied together to perform as a unit when subjected to earthquake forces;

(iv) Parapets and exterior decoration shall be investigated for conformance with regular Code requirements for anchorage and ability to resist prescribed seismic forces. An exception to regular Code requirements shall be permitted for those parapets and decorations which are judged not to be a hazard to life safety;

(v) Nonstructural features of historical structure, such as exterior veneer, cornices and decorations, which might fall and create a life-safety hazard in an earthquake, shall be investigated. Their ability to resist seismic forces shall be verified, or the feature shall be strengthened; and

(vi) Partitions and ceilings of corridors and stairways serving an occupant load of 30 or more shall be investigated to determine their ability to remain in place when the building is subjected to earthquake forces.

6.15.7.1.16.6. The purpose of this regulation is to provide for the use of historical methods and materials of construction that are at variance with regular Code requirements or are not otherwise codified, in buildings or structures designated as qualified historical buildings or properties. This provision requires Building Consent Authority to accept any reasonably equivalent alternatives to the regular Code when dealing with qualified historical buildings or properties.

(i) Any construction type or material that is, or was, part of the historical fabric of a structure present in a historical structure may remain or be reinstalled or be installed with new materials of the same class to match existing conditions;

(ii) Allowable stresses or ultimate strengths for ancient historical materials shall be assigned based upon similar conventional codified materials or on tests. The ancient materials and methods of construction shall be thoroughly investigated for their details of construction. The architect/qualified engineer in responsible charge of the project shall assign allowable stresses or ultimate strength values to these materials. Such assigned allowable stresses, or ultimate strength values, shall be subject to the concurrence of the Authority;

(iii) Where nonstructural historical materials exist in uses which do not meet the requirements of the regular Code, their continued use is allowed by this Code, provided that any public health and life-safety hazards are mitigated subject to the concurrence of the Authority.

6.15.7.1.16.7. Allowable conditions for specific materials: Ancient historical materials which exist and are to remain in historical structures shall be evaluated for their condition and for loads required by this Code. The structural survey required in this Code shall document existing conditions, reinforcement, anchorage, deterioration and other factors pertinent to establishing allowable stresses and adequacy of the archaic materials. These include:

(i) Totally reconstructed walls utilizing original brick or masonry, constructed similar to original, shall be constructed in accordance with the regular Code. Repairs or in fills may be constructed in a similar manner to the original walls without conforming to the regular Code;

(ii) Unburned clay masonry shall be constructed, reconstructed, stabilized or rehabilitated. Alternative approaches which provide an equivalent or greater level of safety shall be used, subject to the concurrence of the Authority;

(iii) Provisions shall be made to protect adobe structures from moisture and deterioration. The unreinforced adobe shall be maintained in reasonably good condition. Particular attention shall be given to moisture content of adobe walls. Unmaintained or unstabilized walls or ruins shall be evaluated for safety based on their condition and stability. Additional

safety measures may be required subject to the concurrence of the Authority;

(iv) Repair or reconstruction of wall area shall utilize unstabilized brick or adobe masonry designed to be compatible with the constituents of the existing adobe materials. Existing adobe shall be allowed a maximum value of (27.6 kPa) for shear, with no increase for lateral forces. Mortar may be of the same soil composition as that used in the existing wall, or in new walls as necessary to be compatible with the adobe brick. Existing wood diaphragms or walls of straight or diagonal sheathing shall be assigned shear resistance values appropriate with the fasteners and materials functioning in conjunction with the sheathing. Existing wood framing members shall be assigned allowable stresses consistent with Codes in effect at the time of construction. Existing or new replacement wood framing shall be of archaic types originally used if properly researched, such as balloon and single wall. Wood joints such as dovetail and mortise and tenon types may be used structurally, provided they are well made. Lumber selected for use and type need not bear grade marks, and greater or lesser species such as low-level pine and fir, boxwood and indigenous hardwoods and other variations may be used for specific conditions where they were or would have been used. Wood fasteners such as square or cut nails may be used with a maximum increase of 50% over wire nails for shear;

(v) Natural cement concrete, unreinforced rubble concrete and similar materials shall be utilized wherever that material is used historically. Concrete of low strength and with less reinforcement than required by the regular Code shall remain in place. The architect/qualified engineer shall assign appropriate values of strength based on testing of samples of the materials. Bond and development lengths shall be determined based on historical information or tests;

(vi) The hand-built, untested use of wrought or black iron, the use of cast iron or grey iron, and the myriad of joining methods that are not specifically allowed by the Code may be used wherever applicable and wherever they

have proven their worth under the considerable span of years involved with most qualified historical structures. Uplift capacity should be evaluated and strengthened where necessary. Fixed conditions or mid height lateral loads on cast iron columns that could cause failure should be taken into account. Existing structural wrought, forged steel or grey iron shall be assigned the maximum working stress prevalent at the time of original construction;

(vii) The historical performance of hollow clay tile in past earthquakes shall be carefully considered in evaluating walls of hollow clay tile construction. Hollow clay tile bearing walls shall be evaluated and strengthened as appropriate for lateral loads and their ability to maintain support of gravity loads. Suitable protective measures shall be provided to prevent blockage of exit stairways, stairway enclosures, exit ways and public ways as a result of an earthquake;

(viii) Historical glazing material located in areas subject to human impact shall be approved subject to the concurrence of the Authority when alternative protective measures are provided. These measures shall include, but not be limited to, additional glazing panels, protective film, protective guards or systems, and devices or signs which would provide adequate public safety; and

(ix) The purpose is to provide regulations for the mechanical, plumbing and electrical systems of buildings designated as qualified historical buildings or properties with an intent to preserve the integrity of qualified historical buildings or properties while providing a reasonable level of protection from fire, health and life-safety hazards (hereinafter referred to as safety hazards) for the building occupants that shall be applied in conjunction with the regular Code whenever compliance with the regular Code is required for qualified historical buildings or properties.

a. No person shall permit any safety hazard to exist on premises under their control, or fail to take immediate action to abate such hazard. Requirements of the regular Code concerning general regulations shall

be complied with, except that the Authority shall accept solutions which do not cause a safety hazard;

b. Qualified historical buildings or properties covered by this part are exempted from compliance with energy conservation standards. When new non historical lighting and space conditioning system components, devices, appliances and equipment are installed, they shall comply with the requirements of this Code except where the historical significance or character-defining features are threatened;

c. Heat-producing and cooling equipment shall comply with the regular Code requirements governing equipment safety, except that the building consent authority may accept alternatives which do not create a safety hazard;

d. Ventilating systems shall be installed so that no safety hazard is created;

e. Plumbing systems shall apply to the acceptance, location, installation, alteration, repair, relocation, replacement or addition of any plumbing system or equipment within or attached to a historical building. These shall comply with the regular Code unless otherwise noted. Existing systems which do not, in the opinion of the Authority, constitute a safety hazard may remain in use;

f. Plumbing fixtures shall be connected to an adequate drainage and vent system. The Authority may require operational tests for drainage and vent systems which do not comply with applicable requirements of the regular Code. Vent terminations may be installed in any location which, in the opinion of the building consent authority, does not create a safety hazard;

g. Indirect and special waste systems shall be installed so that no safety hazard is created. Chemical or industrial liquid wastes which may detrimentally affect the sanitary sewer system shall be pretreated to render them safe prior to discharge;

h. Plumbing fixtures shall be connected to an adequate water distribution system. The Authority may require operational tests for water

distribution systems which do not comply with applicable requirements of regular Code. Prohibited (unlawful) connections and cross connections shall not be permitted;

i. Existing systems, wiring methods and electrical equipment which do not, in the opinion of the Authority, constitute a safety hazard may remain in use;

j. Where existing branch circuits do not include an equipment grounding conductor and, in the opinion of the building consent authority, it is impracticable to connect an equipment grounding conductor to the grounding electrode system, receptacle convenience outlets may remain the non grounding type but protective measures should be taken on fixtures; and

k. Lighting load calculations for services and feeders may be based on actual loads as installed in lieu of the "watts per square meter" method.

6.15.7.1.16.8. This provision covers-preservation, rehabilitation, restoration and reconstruction of associated historical features of qualified historical buildings, that are beyond the buildings themselves which include, but are not limited to, natural features and designed site and landscape plans with natural and man-made landscape elements that support their function and aesthetics. This shall include, but will not be limited to:

(i) Site plan layout configurations and relationships (pedestrian, equestrian and vehicular site circulation, topographical grades and drainage, and use areas);

(ii) Landscape elements (plant materials, site structures other than the qualified historical building, bridges and their associated structures, lighting, water features, art ornamentation, and pedestrian, equestrian and vehicular surfaces);

(iii) Functional elements (utility placement, erosion control and environmental mitigation measures); and

(iv) Where the application of regular Code may impact the associated features of qualified historical properties beyond their footprints, by work performed secondarily, those impacts shall also be covered by this provision and shall require consent of the Authority.

6.15.7.2. GENOCIDE MEMORIAL SITES

6.15.7.2.1. The preservation, restoration, rehabilitation, or reconstruction of buildings or properties designated as genocide memorial sites and buildings or properties shall be governed by different corresponding sections and provisions in this Code. It is intended to provide solutions for the preservation to promote sustainability, to provide access for persons with disabilities, to provide a cost-effective approach to preservation, and to provide for the reasonable safety of the occupants or users. This Code acknowledges and accepts solutions that are reasonably equivalent to the regular Code when dealing with genocide memorial sites.

6.15.7.2.2. It shall be noted that though all buildings in Rwanda are subject to this Code including genocide memorial sites. However this does not preclude the necessity for these sites and buildings to comply with other forms of legislation governing other aspects that forms the decision tool for a corresponding appropriate action including those provided by laws:

(i) Law N° 56/2008 of 10/09/2008 governing memorial sites and cemeteries of victims of the genocide against the Tutsi in Rwanda that sets necessary requirements; and

(ii) Law N° 10/2012 of 02/05/2012 Governing Urban Planning and Building in Rwanda that tasks the implementation to the minister in-charge of urban planning (this Code) in consultations with the minister in-charge of memorial sites.

6.15.7.3. ORDINARY BURIAL SITES

6.15.7.3.1. Each cemetery shall have a map specifying places and numbers reserved for tombs and shall be at least 50cm between tombs and between sideways.

6.15.7.3.2. Each tomb shall bear a visible number which is recorded in the register provided for that purpose. This number shall be provided and affixed by the administration of the Sector in which the cemetery is located.

6.15.7.3.3. Cemeteries shall be located in accordance with the approved local urban land development plan.

6.15.7.3.4. Public cemeteries shall be established in each District. The number, boundaries, surface area and materials shall be determined by the District Council. There shall also established private cemeteries

6.15.7.3.5. Public cemeteries shall constitute part of the District property and shall be managed by the District whereas private cemeteries will be national cemetery in which are buried the high dignitaries of the country, army cemetery and heroes cemetery. The number and use of private cemeteries shall be determined by a Prime Minister's Order and being a part of the State's private property, they shall be managed by the State. However, an Order of the Minister in charge of cemeteries may allow a person or a group of people to establish their own private cemeteries provided they comply with some provisions.

6.15.7.3.6. Tombs shall be classified in the following two (2) categories: ordinary tomb and special tomb. The ordinary tomb is excavated into the soil, not constructed in all its parts. A special tomb is excavated into the soil and constructed in all its parts or at the top only. Special tombs are placed in reserved areas of the public cemeteries .The decision of District Council shall determine the organization and use of such areas reserved for special tombs.

6.15.7.3.7. An Order of the Minister in charge of Local Government shall determine requirements for burying in places of worship.

6.15.7.3.8. A public cemetery may be relocated or closed for public health interest or when fully buried in. A decision of the District Council determines the date of relocation, closure and reopening of a public cemetery. A private cemetery may be relocated or closed for public health interest or when fully buried in. An Order

of the Minister in charge of cemeteries shall determine the date of relocation, closure or reopening of a private cemetery.

6.15.7.3.9. The burial of a dead body in an already occupied ordinary tomb shall not be done before ten (10) years, for a special tomb this will only be done after twenty (20) years from the date the tomb was last buried in.

6.15.7.3.10. All elements of the tomb construction that relate to building construction and architectural aesthetics in relation to materials quality, construction techniques and site safety ,drainage, engineering ethics shall be governed by different relevant provisions of this Code.