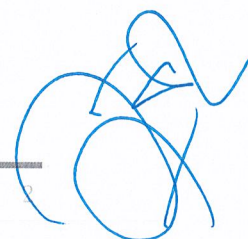


MID-RANGE HOUSING DESIGN GUIDANCE DOCUMENT

Contents

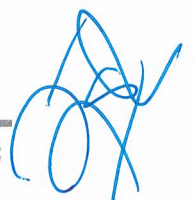
1. INTRODUCTION	3
2. DESIGN CONSIDERATIONS	4
2.1 SITE DEVELOPMENT	4
2.2 BUILT FORM.....	4
2.3 FACADE	5
2.4 PEDESTRIAN & VEHICULAR CIRCULATION	5
2.5 VEHICULAR PARKING.....	6
2.6 FORM, MATERIALS & AESTHETICS	6
2.7 LANDSCAPING DESIGN	7
2.8 PWD ACCESSIBILITY	7
2.9 SUSTAINABILITY	11
2.10 SICK BUILDING SYNDROME	12
2.11 FINISHING SCHEDULE	12
3. BUILDING SERVICES	18
3.1 GENERAL REQUIREMENTS.....	18
3.2 AIR-CONDITIONING AND MECHANICAL VENTILATION SERVICES	19
3.3 FIRE PROTECTION SERVICES	19
3.4 COLDWATER PLUMBING SERVICES	21
3.5 SANITARY PLUMBING SYSTEM	22
3.6 VERTICAL TRANSPORTATION SERVICES (ELEVATOR)	23
4. ELECTRICAL SERVICES REQUIREMENTS.....	24
4.1 GENERAL REQUIREMENTS.....	24
4.2 ELECTRICAL SERVICES	24
4.3 COMMUNICATION SERVICES.....	27
5. References	29



1. INTRODUCTION

The intent of this document is to guide the developer to design this development to local and international standards, guidelines accepted by this corporation.

This document has been established as a guide to functionality, materials, products, workmanship & services. Developers are encouraged to go beyond these standards and recommendations to foster innovative, healthy, efficient, and sustainable housing developments.



2. DESIGN CONSIDERATIONS

2.1 SITE DEVELOPMENT

The most impactful design decisions are often made during the site planning phase, laying the groundwork for a project that positively contributes to the lives of its residents and to its neighborhood, and creating the framework for the rest of the design development.

- Design the development to take into consideration the potential negative impacts of adjacent properties, including but not limited to, overshadowing, overlooking & wind tunnel effect.
- Consider prominent view corridors and physical intersections.
- Design and orient the building to take into consideration climatic factors where there are maximum benefits to be derived from natural lighting, energy efficiency (e.g. Solar heat gain), and protection from weather elements. The installation of a future solar thermal system or solar photovoltaic system must be considered.
- Design the ground floor of the building to express the individuality of the residential and commercial units, if applicable, through architectural expression and the inclusion of entrance doors, canopies, and windows addressing the street. Ensure appropriate sidewalk width is provided to accommodate the anticipated pedestrian traffic flow.
- Utilize the existing site's features in creating compatible and well-defined amenity areas for adults and/or child-oriented activities. Minimize the overshadowing of amenity spaces by neighboring buildings. Create shading through natural means (e.g. Deciduous tree planting).
- Consider vehicular, bike, and pedestrian circulation through and around the site.
- Create well-defined public places (street, garden, park, walkway, mews, square, etc.) through the massing of built-form. Avoid creating residual, unusable spaces.
- Establish play area within walking distance from residential units (dwellings, windows) and/or communal spaces.
- At corner developments, consider concentrating any commercial activities along the main thoroughfares and allow for residential and more passive uses alongside streets.
- At midblock or infill sites, consider small-scale strategies, such as orientation and screening, to mitigate sub-optimal conditions, such as noise, traffic, and unpleasant views.

2.2 BUILT FORM

The mass of a building—its form and size—accommodates interior program while also providing a sense of identity and presence on the street. Massing articulations, such as varied building heights and setbacks, can visually connect a building to adjacent structures and respond to a neighborhood's character and scale.

Thoughtful and well-designed massing can help to make even a large residential building sensitive to the pedestrian scale and feel like home. Working within zoning constraints, the mass of a building should be designed to take advantage of a site's best features, including views and connections to neighboring buildings while also mitigating any challenging conditions.

- Design the development to take into consideration the potential negative impacts of adjacent properties, including but not limited to, overshadowing, overlooking & wind tunnel effect.
- Consider breaking up the scale of overall massing to relate to lower or adjacent building heights.
- Consider using setbacks to optimize views and public outdoor spaces, such as yards and terraces

- At corner developments, consider concentrating bulk adjacent to existing buildings with height, and integrating lower heights adjacent to open spaces and pedestrian thoroughfares.
- At midblock or infill sites, consider concentrating bulk at the center of the building, and stepping down toward adjacent lower buildings and the street.

2.3 FACADE

Façades are building's "faces" to the neighborhood, bringing together massing and material decisions to create presence and character. While a street-facing façade can help to create a welcoming identity for the building and its residents, buildings often have visible rear and side façades, giving additional design opportunities.

The façades of a building should be designed with colors, materials, and articulations that form a coherent image. Different faces should be designed in response to interior programs and site conditions. It may be appropriate, for instance, to have distinct and complementary façade designs for street- and rear-facing sides of a building. A beautiful façade can help give residents and neighbors a sense of dignity and feeling of home.

The following points must be taken into consideration when designing the façade of the establishment.

- Consider how façade design can help enhance the building's character and identity both in the existing community and for its residents.
- Consider how each façade uniquely responds to adjacent programs and conditions.
- Consider avoiding co-planer material connections to further break down the overall massing.
- Consider using functional components, such as sunshades or window frames, to provide depth and shadow lines.
- Consider adding green walls or ornamental plants to the façade.
- Building services should be screened with proper access for maintenance, within the façade.

2.4 PEDESTRIAN & VEHICULAR CIRCULATION

- Sidewalks shall be provided along the full length of the building along any facade bordering streets and parking areas, where workable.
- Locate additional site access points for loading and unloading and back of house services as far as possible from street intersections to minimize conflicts.
- Pedestrian walkways shall be differentiated from driving surfaces through the use of durable landscape treatments and/or surface materials.
- All pedestrian ways shall be scaled to the use and expectations of pedestrian volumes in any given location with the minimum width of the sidewalk, no less than 1.5m.
- Sidewalks shall connect main areas of pedestrian activity such as transit stops, street crossings, building and store entrances, bike racks, and feature adjoining landscaped areas that include trees, shrubs, lighting, signage, benches, flowerbeds, groundcovers or other similar amenities.
- Ensure that the internal road networks and flow of traffic within the boundary shall be designed to complement the development.
- Design the layout of walkways to follow natural pedestrian traffic patterns with a hard surface such as concrete, unit pavers, natural stone pavers, or other suitable material, to discourage routing across lawns and play areas.
- Consider the design of garbage and move-in/out areas to ensure the ability of large trucks to maneuver.



2.5 VEHICULAR PARKING

- All parking must be accommodated within the plot area. & according to parking requirements.
- Controlled/structured parking and surface can be located at the perimeter of the lot adjacent to the access roads.
- Controlled/structured parking, mechanical parking, and or surface parking can be proposed by the developer.
- Provide separate vehicular and pedestrian circulation systems with a strong emphasis on pedestrian linkages between uses. Make provisions for pedestrian routes through the parking area(s) with sightlines at intersections of walkways and vehicular traffic.
- Separate parking aisles from primary vehicle circulation routes and entry drives whenever possible.
- Use design elements that are visually interesting and consistent with other streetscape materials used in the overall development.
- Utilize Universal Design techniques where feasible to provide a separation between driveway curb-cuts and drop-off areas to minimize turning conflicts; provide a clear separation of vehicular traffic between drop-off zones and access to either a parking lot or parking structure; and design drop-off lanes so as not to obstruct traffic flow when motorists are stopped to discharge passengers.

2.6 FORM, MATERIALS & AESTHETICS

Both aesthetic and functional, building materials can enhance a development's massing and Façade strategy, while also contributing to overall building identity. Materials also contribute To a development's environmental impact, constructability, and durability. By selecting Sustainable materials as part of a high-performance building envelope, designers can reduce Environmental impact and energy costs.

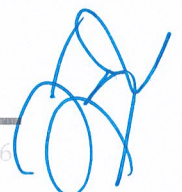
Materials should be selected with local construction expertise in mind, noting that a well-designed building requires quality construction. Durable, easily-maintained materials can contribute to the longevity of a building; up-front investment in materials and construction details often results in cost savings over time by reducing the need for renovations.

2.6.1 GENERAL MATERIAL REQUIREMENT

- Establish consistent levels of material quality and detail.
- To encourage materials that are complimentary to the large-scale open landscape and natural surroundings.
- All primary building facades shall incorporate materials that are durable, economically maintainable, and of a quality that will retain their appearance and finish over time & withstand climatic conditions.

2.6.2 SIGNAGES

- Provide a comprehensive signage system that considers the orientation, location, direction, and distance of signage based on the physical layout of the project.
- Ensure that all exterior signage is durable, low maintenance, and vandal resistant.
- Provide project identification sign(s) at the main entrance that includes the development name and address.
- Provide internal way-finding signage in all driveways, parking areas, lobby areas, and at each elevator location.
- Provide metal/cast aluminum door numbers and plates. Door numbers are to be centered within the door width at a height of 1,800 mm (70 in.) From the ground to the top of the plate using tamperproof membrane screws.
- Provide text and identification plates for all multi-purpose and utility rooms.
- Provide traffic signs & floor marking wherever needed.



2.7 LANDSCAPING DESIGN

Outdoor open spaces are critical amenities for residents, and can also provide benefits to the general public. Extending from interior common spaces, front and rear yards, as well as other kinds of open space, such as terraces, are vital design components that can help connect a new building with adjacent development and existing urban fabric.

Front boulevards often provide a semi-public threshold between private development and the street, while courtyards, terraces, and rooftops are typically favorite places for residents to gather. Open spaces should be designed and landscaped to accommodate residents' and neighbors' desired uses and to contribute to sustainability and resiliency goals.

- Design landscaping to compliment the development and amenity spaces, enhance the image of the neighborhood and address practical considerations, such as wind protection, buffering, and shade.
- Use landscaping for practical benefits and solutions, such as:
 - A colonnade of trees for protection from sun, rain, and wind.
 - A grid of trees that will produce a “roof canopy” of foliage to create a secluded sitting area for passive recreation.
 - A berm adjacent to an open sodded area, which will act as a separation between outdoor spaces and can also, be used for an informal sitting area.
- Consider planting hardy, water saving, indigenous species, especially in passive areas, to reduce the demand for irrigation and maintenance.
- Plantings along streets, at monument signs, and other key locations shall be designed using a plant palette and design approach as defined in these guidelines.
- The development of building sites shall be consistent in landscape design to provide overall continuity to the project. Landscape treatments of the building site, parking lots, and streetscape are critical elements of the site development.
- Incorporate landscaping elements to provide maximum shade for hard surface areas.
- Design site-landscaping layout to accommodate and support all desired and required outdoor activities, such as garden plots and or outdoor exercise areas.
- Ensure outdoor furniture design on the site is durable and unified in style (e.g. Garbage receptacles, benches, etc.).
- Ensure that all aspects of outdoor landscaping are PWD friendly.

2.8 PWD ACCESSIBILITY

The following points are to be considered when designing to ensure that the development is universally accessible.

GENERAL SPACES

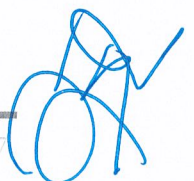
2.8.1 SIGNAGE

- Sign surface should prevent Glare & be of a durable weatherproof material
- Colors should contrast with the surrounding surface to avoid confusing people with low vision & blindness
- Color combinations should be red & green or yellow & blue to avoid confusing people with low vision & blindness
- Letters should be sized in proportion to the reading distance
- The international symbol of access should be used where appropriate

2.8.2 PATHWAYS

Pathways include paved and unpaved footpaths. They must be safe for all users, particularly people with low vision and blindness or mobility disability.

- Clear of all obstructions



- Seal or upgrade unpaved footpath surfaces, where possible, since these often become hazardous in adverse weather conditions
- Construct slopes that do not exceed a gradient of 1:12
- For slopes that exceed 1:12, install ramps and allow for landings with a minimum dimension of 1 m x 1 m every 9 m, to enable rest opportunities
- Use smooth, continuous, non-slip and even surfaces for all pathways
- Install a guide strip comprising a tactile line in a color that contrasts with the pavement for people with low vision and blindness
- Install tactile tiling on pedestrian routes of travel, with a minimum 30% luminance contrast to adjacent surfaces
- Place tactile tiling at pedestrian crossings and around obstructions that are difficult for people with low vision and blindness to detect
- Avoid stepped curbs or, if required, ensure they are between 70 mm and 150 mm high
- Place drains, grating and manholes outside pedestrian pathways to avoid potential changes in pathway texture and height
- Cover all drains, gratings, and manholes for safety, ensuring covers are level with the path surface and have narrow grid patterns

2.8.3 PARKING

Parking spaces

- Locate disability-reserved parking spaces no more than 50 m from a main building entrance
- Design car parking spaces for people with disability that are a minimum width of 3.4m x 4.8m with an adjacent minimum 2.4 m wide shared space for wheelchair transfers
- Design motorbike parking spaces for people with disability that are a minimum width of 1.5m x 2m
- Provide same-level access from disability-reserved parking spaces to kerb
- Ramps and pedestrian pathways where possible.

Drop-off zones

- Design at a minimum 3.2 m wide for ease of mobility and safety
- Make parking spaces for people with disability wide enough to accommodate two cars
- Position within 30 m of accessible building entrances to reduce the need to travel long distances
- Provide curb ramps to negotiate changes in level from parks to footpaths
- Provide clear signage to reduce potential for confusion
- Provide tactile guide strips for improved security and safety
- Consider installing bollards to define zones.

2.8.4 DOORS

- Install each door with a door handle, extra pull handle, glazing, kick plate and sign
- Select doors with a minimum of 2 m clear height to avoid head contact with the top of the door frame
- Install single doors at the recommended minimum clear opening of 850 mm
- Install door hardware, such as latches, locks, handles and pulls, that can be easily grasped with one hand
- Provide lever-type handles, not knobs, for ease of use
- Incorporate recesses at doors in corridors to avoid obstructing main traffic
- Paint door and/or door frames in a color of a minimum 30% contrast with the adjoining wall to help people with low vision and blindness identify them
- Install automatic sliding doors, where possible, where circulation space is restricted

- Avoid spring-operated doors which are hard to pull open and can be a hazard when swinging back (if spring-operated doors are used, two-way opening doors with an adjacent window are preferred)
- Avoid door swings extending over steps or ramps and set back at least 1.5 m to avoid tripping and falling
- Position door swings to account for the space being entered (for example, with wheelchair accessible toilets, doors should open outwards or be sliding).

2.8.5 ENTRANCES & LOBBIES

Entrances

- Make at least one entrance, preferably the main one, accessible by people using wheelchairs
- Connect accessible pathways to accessible indoor and/or outdoor parking areas, drop-off areas, local public transit stops and public footpaths
- Provide adequate covered space in front of entrances for shelter and protection from adverse weather conditions
- Paint entrance doors in a color that contrasts with surrounding surfaces
- Provide lighting at entrances and along accessible pathways.

Lobbies

- Make lobbies accessible for people using wheelchairs and provide enough space for their maneuverability
- Construct counters 850 mm \pm 20 mm high for ease of mobility and engagement with staff or communication items like telephones
- Provide public seating outside main circulation paths so people can engage socially, rest or wait
- Choose furnishings of colors that contrast with the floor and surrounding walls for easy maneuverability

Corridors

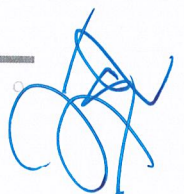
- Allow for an unobstructed clear path of travel with a minimum width of 1.5 m (preferably 1.8 m), for ease of mobility and maneuverability with other pedestrians (low traffic corridors should be a minimum 1 m width)

2.8.6 HANDRAILS & RAILINGS

- Provide handrails around all accessible balconies, galleries, hazardous areas, platforms, ramps, roofs and stairs for safety, assistance and rest opportunities
- Install handrails at a minimum height at 1200mm at apartments
- Check that installation arrangements are in line with safety and accessibility guidelines.

2.8.7 INSTALLING RAMPS

- Provide ramps when stairs obstruct the free passage of pedestrians and people with disability
- Provide at least one accessible entrance to a public building, preferably the principal entrance
- Locate ramps immediately adjacent to entrances, lobbies, and stairs
- Calculate sufficient space for ramps and landings to provide appropriate slope and include rest and passing areas
- To all services and facilities should be addressed and incorporated into any design, which could include upper floor access by way of a ramp.
- Slope: 1:12 is the recommended minimum for a non-assisted person in a wheelchair. The slope can be increased to 1:10 where the wheelchair user is assisted.
- Width: Varies according to use, configuration, and slope, but the minimum is 1 m.



- Landings: Provide at least every 9 m, at every change of direction and the top and bottom of every ramp. Landing width should be a minimum of 1 m and clear from obstructions.
- Handrails: Provide on both sides and along the full length of every ramp, 900 mm to 1 m high, returning at ends or turning down to minimize injuries. Handrails should extend for a distance of a minimum of 300 mm at the top and bottom of ramps. For ramps wider than 3 m, an intermediate rail could be installed.

2.8.8 ELEVATORS

- Ensure the dimension of elevator enables easy access by a person in a wheelchair
- Install a handrail on at least two sides
- Position the control panel so it is easily accessible and can be easily viewed
- Install door re-opening activators, audio-visual signals, and floor audio announcements
- Install a non-skid floor
- Select a door color that contrasts with the color of the walls, floor and the landing area in front of elevator doors
- Provide minimum elevator floor space of 1.4 m x 1.6 m
- Provide controls positioned 850 mm to 1.2 m high
- Install braille and tactile signage at the appropriate height.

2.8.9 STAIRS

Steps

- All steps in one flight should be uniform.
- Steps should be 150 mm to 180 mm high and not less than 260 mm deep.
- Open riser staircases should not be used as they pose a risk.
- Angled risers are preferred to nosing's, but if nosings are used they should be rounded and not project more than 40 mm.
- Nosings should have permanent color contrasts to facilitate ease of use for people with low vision and blindness.
- Stair covering should be slip-resistant, firmly fixed, and easy to maintain.
- Landings should be provided at least every 15 steps to assist people who cannot manage long staircases.
- Each landing should be at least 1.2 m long.

Width

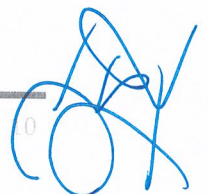
- The clear width of stairways should be at least 1 m, preferably 1.5 m allowing for easy two-way traffic.

Handrails

- Handrails should be provided on both sides of a flight of stairs and each side of landings.
- With wider stairs, intermediate handrails should be installed.
- Handrails should be positioned between 800 mm and 1 m above the floor finish.
- Handrails must extend a minimum of 300 mm beyond the top and bottom steps, turning to the wall.
- Handrails should be supported on brackets that do not obstruct continuous hand contact with the handrail.

Tactile marking

- Tactile warning strips should be provided at the top and bottom of stairs and at intermediate landings, to alert people with low vision and blindness to the location of the stairs.
- A textural marking strip is essential and should be at least 600 mm deep, extending over the full width of the stairs.



Accessibility Design Guide

- To provide orientation for people with low vision, the marking strip should be in a color that contrasts with the surrounding surface.

Lighting

- Staircases should be well lit during all hours of the day.

2.9 SUSTAINABILITY

A key design aim should be to consider & ensure that each housing scheme is economically, socially, and environmentally sustainable. This is facilitated by:

- The provision of a pleasant living environment which meets the needs, and, as far as possible, the preferences of the residents and fosters the development of the community;
- The encouragement of energy efficiency both at construction stage and during the lifetime of the building e.g. By climate-sensitive design which takes account of the orientation and surrounding features to control wind effects while optimizing sunlight, daylight and solar gain benefits;
- Having due regard to the social and environmental consequences associated with the use of materials and resources, e.g. Minimizing the use of scarce non-renewable resources and using renewable resources and materials which have minimum environmental consequences, wherever practicable; and
- The integration of the new housing into the existing natural and built environment in a way that makes a positive contribution to the overall environment of the locality.

The degree to which the designer can favorably influence micro-climate is frequently determined by the size, location, and nature of the site. In deciding on the site layout, designers should have regard to:

- The scope for optimizing daylighting and solar gain for dwellings through the orientation and spacing of buildings;
- The scope for optimizing the advantages of shelter and direct sunlight through the location and orientation of play areas, courtyards and gardens relative to existing features both on and adjacent to the site, e.g. Buildings, walls, trees, hedges;
- The scope for ground shaping and landscaping to provide greater shelter and limit the extent of overshadowing of buildings, play areas and other areas which are intended to be extensively used by residents; and
- The need to limit funneling and channeling of the wind, e.g. Appropriate building spacing and orientation, avoidance of long straight building lines, avoidance of passageways through buildings.
- Aim to maximize the use of existing natural drainage patterns and to limit the requirement for separate disposal of surface water offsite. The extent of new impervious surfaces should be limited to reduce peak surface water runoff.
- The choice of materials for site works should have regard to cost, performance, durability, maintainability, and overall environmental impact.
- Due regard should be had to the full lifecycle cost and environmental impact of the materials used. The potential for recycling and reuse should also be taken into account.
- There should be a preference for material from renewable or recycled sources, where available, economic and appropriate for the function.
- The design should aim to ensure that all materials should be used efficiently with a minimum of waste.

2.10 SICK BUILDING SYNDROME

The designer & developer must consider, document & explain the expected lifecycle of systems & components. From the evidence to date, some risk factors have been identified and which should be avoided if possible. These include:

- Poor provision for daylight and/or uncontrolled solar gain,
- Sealed windows,
- Large areas of soft furnishing, open shelving, and filing,
- Use of inadequately tested materials, paints, joining mastics, and glues,
- Type of lighting and position giving glare and flicker,
- Services and areas not designed for easy cleaning and maintenance.

The interaction between airtightness, ventilation and emissions must be understood. A relatively small mistake in one area may be reinforced elsewhere and create a substantial problem. Key factors in this area are the following:

- Provision of sufficient fresh air (at least 8 liters per second per person in non-smoking areas and up to 30 in smoking areas)
- Air inlets that are not close to exhaust or outdoor pollution sources and that are supplied with adequate filtration
- Removal or dilution of airborne pollutants (e.g. Separate extract ventilation from office machinery and smoking rooms)
- Provision of a comfortable temperature, related to the activities in the building
- Prevention of air stagnation and draughts (airflow rates 0.12-0.3 m/s)

2.11 FINISHING SCHEDULE

This finishing schedule sets the standard for the finishes in mid-range housing. The developer is asked to use this as a reference when finalizing the finishes of the spaces as mentioned in the schedule. The developer is to ensure the quality & durability of the proposed materials by reviewing the specifications & test reports pertaining to the proposed materials. It is advised that all the materials are of ISO standards. If the developer or contractor is to propose an alternative material other than given in the table, the developer or contractor is required to submit to HDC for approval.

COMMON FACILITIES & SPACES

	FLOOR	WALL	CEILING	NOTES
ENTRANCE LOBBY	Homogeneous tile Non-slip finish (600x600mm)	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Glazed aluminum sections are preferred to provide good visibility & natural light in the building
ELEVATOR LOBBY	Homogeneous tile Non-slip finish (600x600mm)	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	
PUBLIC	Homogeneous tile	Smooth putty	Smooth putty	Provide corner guards

CORRIDORS	Non-slip finish (600x600mm)	finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	at all exposed corners & handrails on one side
EXIT STAIRS	Concrete, epoxy painted	Concrete, epoxy painted	Concrete, smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Paint/powder-coated GI handrail & railings
MANAGEMENT OFFICE	Porcelain tile Non-slip finish 300x300mm	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	
MULTI-PURPOSE ROOM	Porcelain tile Non-slip finish (600x600mm)	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	All paint must be washable.
STORAGE ROOMS	Concrete, epoxy painted	Concrete, epoxy painted	Concrete, smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	
PUBLIC WASHROOMS	Porcelain tile, non-slip (300x300mm)	Porcelain tile up to ceiling level on all walls	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Concealed flush tank for WC
PARKING	Concrete, epoxy paint. Spaces to be marked & numbered	Painted concrete. Columns painted base color coded to each level	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Provide protection & jacketing to all exposed services. Exits & lobby areas to be clearly identified/ color-coded for each level. Columns to be painted in contrasting color to floor paint.
GARBAGE ROOM	Concrete, epoxy	Porcelain tile up to	Smooth putty	

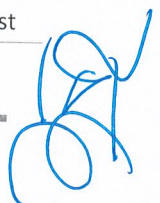
	flooring	a minimum 1,800mm on all walls	finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	
JANITORS ROOM	Porcelain tile, non- slip (300x300mm)	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	
SERVICE ROOMS	Concrete, epoxy painted	Concrete and/or block, epoxy painted	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Provide structural backing for equipment
MEETING ROOM	Porcelain tile Non-slip finish (600x600mm)	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Smooth putty finish with base sealer & 2 coats of paint as specified by client	
SECURITY ROOM	Porcelain tile Non-slip finish 300x300mm	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Smooth putty finish with base sealer & 2 coats of paint as specified by client	

Apartments

	FLOOR	WALL	CEILING	NOTES
LIVING ROOM	Porcelain tile, non- slip (600x600mm)	Smooth putty finish with base sealer (primer)	Ceiling shall be smoothed and finished with base sealer (primer)	<ul style="list-style-type: none"> • Adequate lighting must be provided for the entire area. • Fans and socket outlets at a relevant location shall be provided. • Cable TV & Internet connection outlets.



KITCHEN & DINING	Porcelain tile, non-slip (600x600mm)	Smooth putty finish with base sealer (primer)	Ceiling shall be smoothed and finished with base sealer (primer)	<ul style="list-style-type: none"> • Adequate lighting must be provided for the entire area. • Water connection & drainage outlet must be provided to relevant kitchen fixture locations. • Fans and socket outlets at a relevant location shall be provided for all general home appliances • Provision for kitchen exhaust/hood must be provided
BEDROOMS	Porcelain tile, non-slip (600x600mm)	Smooth putty finish with base sealer (primer)	Ceiling shall be smoothed and finished with base sealer (primer)	<ul style="list-style-type: none"> • Adequate lighting must be provided for the entire area. • Fans and socket outlets at a relevant location shall be provided.
TOILETS	Porcelain tile, non-slip (600x600mm)	Walls shall have porcelain ceramic wall tiling to full height from FFL (Floor Finish Level).	A suspended ceiling, preferably with plastic based tiles.	<p>Adequate lighting must be provided for the entire area.</p> <p>All fixtures & fittings such as a washbasin, bidet shower, water closet and shower must be provided. Shaver/hairdryer & heater socket must be provided</p>
BALCONY	Porcelain tile Non-slip finish (600x600mm)	<ul style="list-style-type: none"> • Smooth putty finish with base sealer (primer) • GI railing shall be provided on the top of the balcony walls. • Balcony wall can be of full height decorative GI depending on the design. 	Slab soffit to be smoothed with putty and finished with base sealer (primer)	Adequate lighting must be provided for the entire area.
LAUNDRY	Porcelain tile Non-slip finish (600x600mm)	Walls shall have ceramic wall tiling to 1.8M from F.F.L (Floor finish level)	Ceiling shall be smoothed and finished with base sealer (primer)	<ul style="list-style-type: none"> • Adequate lighting must be provided for the entire area. • Socket for washing machine must be provided • Dedicated drainage must



be provided

MAID ROOM	Porcelain tile, non-slip (600x600mm)	Smooth putty finish with base sealer (primer)	Ceiling shall be smoothed and finished with base sealer (primer)	<ul style="list-style-type: none"> • Adequate lighting must be provided for the entire area. • Fans and socket outlets at a relevant location shall be provided.
------------------	--------------------------------------	---	--	--

COMMERCIAL UNITS

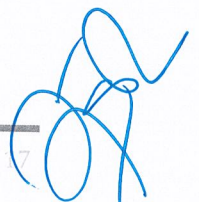
	FLOOR	WALL	CEILING	NOTES
PUBLIC CORRIDORS	Homogeneous tile Non-slip & weather resistant finish outdoor (600x600)	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Provide corner guards at all exposed corners & handrails on one side
STAIRS	Concrete, epoxy painted	Concrete, epoxy painted	Concrete, smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Paint/powder-coated GI handrail & railings
COMMERCIAL UNITS	Bare screed finish	Smooth putty finish	Smooth putty finish	
STORAGE ROOMS	Concrete, epoxy painted	Concrete, epoxy painted	Concrete, smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	
PUBLIC WASHROOMS	Homogeneous tile, non-slip	Tile up to ceiling level on all walls	Smooth putty finish with base sealer & 2 coats of paint as specified by manufacture and approved by client.	Concealed flush tank for WC

NOTE:

- Skirting – must be provided in all the spaces at 100mm from finish floor level.
- Paint – to be selected by the client. 2 coats must be applied with a base sealer (also should fulfill the manufactures requirement for the approved paint).
- GI grade: BS 1387 (class a/b/c)
- Additional safety measures, to minimize the risk of falling over, should be taken if horizontal railings are to be provided

Doors & windows

- Aluminum doors & windows should be of 1.2mm thick & powder coated with a thickness of 60-80 microns
- All main doors should be solid wooden doors with a minimum fire rating of 1 hour.
- All main doors should have a minimum of 4 hinges, lock handle, chain bolt latch & peephole.
- Glazing used for doors and windows should be safe and with a nominal thickness proportionate to the area of the panel



3. BUILDING SERVICES

This section provides the general requirements for the mechanical services of a mid-range residential building.

The basic Mechanical Services covered in this section are: -

- 4.2 Air-conditioning and mechanical ventilation services;
- 4.3 Fire Protection Services;
- 4.4 Cold Plumbing Services;
- 4.5 Sanitary Plumbing Services;
- 4.6 Vertical Transportation Services (Elevator Services)

3.1 GENERAL REQUIREMENTS

- All relevant works must comply with the requirements of local and statutory authorities having jurisdiction over part/s of the works including but not limited to:
 - a) Housing Development Corporation (HDC)
 - b) Male' Water & Sewerage Company Pvt Ltd (MWSC) – Water and Sanitation Authority
 - c) Maldives National Defense Force (MNDF) – Fire Protection Authority
 - d) Ministry of Environment & Energy
 - e) Ministry of Health

- According to the Intergovernmental Panel on Climate Change (IPCC), buildings are responsible for one-third of all Green House Gas (GHG) emissions. In addressing to this, several measures as below can be taken in order to design a building that will be more energy efficient.
 - Energy saving lighting system with motion sensors;
 - Efficient equipment in buildings

- Service areas shall occur away from public streets, parks, plazas, and adjoining development.
- Views of service areas from streets, parks, plazas, pedestrian walkways, and adjoining development shall be screened.
- Screening enclosures shall be incorporated into the building architecture and utilize the same materials as the principal building to the greatest degree possible.
- Screening shall include walls or fences of a minimum height of 6 feet to provide complete screening from normal eye level on all sides where access is not needed.
- When designing the mechanical services, the developer must ensure that all aspects, wherever possible, is PWD friendly. All emergency services must be designed so that in case of an emergency, a person with any form of disability is aware of the situation.
- All the mechanical services must be suitable for local weather conditions (marine environment).
- It is recommended that consultation be done at concept level with services providers of electricity, plumbing, sewerage, telecommunication, and cable TV, as to how these could be economically and sustainably incorporated into the development.
- Any space required by the relevant service provider for the installation or provision of a supporting facility (transformer, pump rooms, storage tanks, service stations, etc.) Should be provided well within the given area for the development
- Dedicated utility space at either ground or first floor level should be provided for the provision and/or installation of relevant services as required

- The developer is required to submit a proposal for the below mentioned systems during the concept stage and the drawings needed for the said systems must be submitted during the detail drawings submission.

3.2 AIR-CONDITIONING AND MECHANICAL VENTILATION SERVICES

3.2.1 Design considerations

Design principles, equipment selection, and material specifications must be in line with good engineering practice and must give due regard to the following: -

- Comfort conditions;
- The simplicity of design and installation;
- Ease of operation and maintenance;
- Energy conservation and environmental impact;
- System flexibility and adaptability;
- Recognized and acceptable design standards;
- Screened within the façade to be aesthetically appealing,
- During the design stage, take consideration to provide AC & AC outdoor unit provisions.
- Provide kitchen hood outdoor unit provisions.
- Toilet ventilation provisions

3.2.2 Regulations & Standards

The latest edition of the following standards must generally apply to the design of the air conditioning and mechanical ventilation systems. Where there is a difference in standards or requirements between two documents or between a document and the specific requirements of the local authorities having jurisdiction, the more stringent standard or requirement must be applicable:

- Indoor Air Quality (IAQ)
- The latest edition of ASHRAE 62 "Ventilation for Acceptable Indoor Air Quality"
- Latest Edition of SMACNA, ASHRAE, and ARI standards.
- CIBSE guidelines

3.2.3 Mechanical Ventilation System

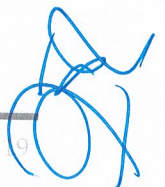
Mechanical ventilation must be provided in all services areas.

- Air filtration
 - The air filtration system must generally be designed in accordance with the above mentioned standards.
- M&E Plant rooms
 - Pump rooms, electrical transformer, and switchgear rooms, refuse chamber and other electrical rooms must be mechanically ventilated.
 - All M&E Plant rooms must be separated from each other
- The ventilation system must be provided with automatic controls to turn on and off on demand. Manual override systems must be provided to manually operate the ventilation system as needed. The ventilation system must also be interlocked with the fire protection system.

3.3 FIRE PROTECTION SERVICES

The section covers the general requirements for Fire Protection Systems.

- Portable Fire Extinguisher
- Automatic Carbon Dioxide System (for Electrical Low Voltage Room and Genset Room)
- Clean Agent for Electrical Substation
- Hose Reel System



- e) Wet Riser System
- f) Automatic Fire Detection System

3.3.1 Regulations & Standards

- The following standards, codes of practice, and regulations must apply for all works carried out in this contract.
 - a) National Fire Protection Association (NFPA)
 - b) Maldives National Defense Force (MNDF)
- All design must comply with the Statutory Regulations and requirements of the relevant Government Agencies & Local Authorities.
- Submission of plans to the authorities must be performed by registered Professional Engineers.
- Commissioning and testing of the Fire Protection facilities must be carried out by a qualified fire protection developer registered with MNDF
- All emergency services must be designed to be PWD friendly. In case of an emergency, a person with any form of disability must be aware of the situation.

3.3.2 System Requirements

a) Automatic Fire Detection and Alarm System

- The building must be equipped with a fully addressable type Automatic Fire Detection & Alarm System.
- The main fire alarm panel must be installed in Fire & Water Room located at the Ground Level.
- Incoming water supply into Sprinkler and Wet Riser / Hose Reel tanks must be from external water mains and also from seawater in the event of a fire.
- Addressable heat/smoke detectors must be installed within the elevator lobbies and M & E Rooms.
- Manual call points and alarm sounders with strobe lights must be installed to provide manual activation of fire alarm and must be located along escape routes and outside staircases.
- The manual call points must be of the break-glass type surface mounted at 1.4m above floor level.
- Ensure that the fire alarms have strobe lights.

b) Portable Extinguisher

- Approved type Portable extinguisher will be located beside hose-reels and along escape routes for ease of identification and access.
- Suitable extinguishers must be provided for mechanical and electrical plant rooms.

c) Automatic Carbon Dioxide System

- Carbon Dioxide System must be designed based on NFPA 12 requirements and must be installed in unmanned areas such as Electrical Low Voltage Rooms or Consumer Room, Gen Set Rooms, IT Server Rooms, Energy and Power Authority Switchgear Room and Transformer Rooms to meet Fire Protection Authority and Energy and Power Authority's requirement.

d) Hose Reel System

- The Hose Reel system must be designed to BS 5306 Part 1 and complying with the requirements of the Local Fire Department.
- Generally, all escape staircases, escape routes and large areas must be provided with hose reels. They will be located such that all parts of each floor are within 30m of the nearest hose reel.



- The hose reel drum must include 25mm dia. X 30m long approved type hose and nozzle located inside the hose reel riser or cabinet with glass front panel. Suitable signage must be provided.
- During regular pump testing, the valve along the Test Line of the Hose Reel System must be opened to allow the water to be returned to the Fire Fighting Water Storage Tank instead of being discharged into the drain.

e) Wet Riser System

- The Wet Riser must be designed to the local Fire Department and BS 5306 Part 1.
- Landing valves must be located at max. 60-meter radius at each floor and to which a rubber-lined hose with nozzles can be connected.
- The landing valve and hose must be located in the same compartment complete with a glass front panel.
- During regular pump testing, the valve along the Test Line of the Hose Reel System must be opened to allow the water to be returned to the Fire Fighting Water Storage Tank instead of being discharged into the drain.

3.4 COLDWATER PLUMBING SERVICES

The section covers the general requirements of the Cold Water Plumbing Services. Generally, the works for the Cold Water Plumbing services must include the following: -

- Coldwater should be supplied directly from mains to the storage tank in each building.
- Coldwater storage tank must be provided
- Tanks must be easily accessible for maintenance purposes.
- The tank sizes shall be calculated in accordance with the regulations and necessary guidelines by the relevant authorities.
- The tanks must comply with all health and safety requirements for the storage tanks.
- The rainwater tank overflow must be connected to the ground well tank, where the ground well must be used primarily for irrigation purposes.
- Recommended to use any brand of quality which is available locally, such as DAVEY or equivalent.
- Pressurized pipes shall be higher grade such as PPR
- Gravity pipes shall be higher grade such as HDPE
- The water quality should comply with the standards set forth by the Health Protection Agency (HPA) if proposed to use a private water supply
- It is highly recommended to have adequate storage of water (rainwater harvesting integrated) within the development for firefighting and any other emergency usage

All materials should be suitable for Maldivian Environment (Marine Environment) Which is locally available

The developer is required to submit a proposal for the above-mentioned systems during the concept stage and the drawings needed for the said systems must be submitted during the shop drawings submission.

3.4.1 Regulations & Standards

- The following standards, codes of practice, and regulations must apply for all works carried out in this contract.
 - The relevant British Standard Specification (BS)
 - Male' Water and Sewerage Company Pvt. Ltd. (MWSC)
 - Latest Edition of ASHRAE standards
- All design must comply with the Statutory Regulations and requirements of MWSC.
- Submission of plans to the authorities must be performed by Professional Engineers. Commissioning and testing of the Cold Water and Sanitary facilities must be carried out by the qualified Cold Water and Sanitary contractor registered with MWSC and Local Authority.

3.4.2 System requirements

- The Domestic Cold Water System tank must have 1-day storage capacity equipped with pumping system.
- The cold water pumping system must be provided with the essential electrical supply.

3.5 SANITARY PLUMBING SYSTEM

Generally, the works for the Sanitary Services must include, but not limited, to the following:

1. Internal soil, waste, vent and anti-siphon, pipework, fittings, and accessories for all toilets.
2. Domestic manholes, floor traps, gully traps, and accessories.
3. The drainage system shall be directly connected to the Municipal mains.
4. Essential power supply to pump control panels c/w wirings.

3.5.1 Regulations & standards

- All design must comply with the Statutory Regulations and requirements of MWSC.
- The developer is required to submit a proposal for all the Cold Water Plumbing Services during the concept stage and the drawings needed for the said systems during the shop drawings submission.
- Submission of plans to the authorities must be performed by Professional Engineers. Commissioning and testing of the Cold Water and Sanitary facilities must be carried out by the qualified Cold Water and Sanitary contractor registered with MWSC and Local Authority.


3.5.2 System Requirements

- The developer must propose a sanitary plumbing system to dispose of all soil and wastewater from all sanitary fixtures.
- Ensure water supply is separately measured for each residential unit, amenity space, parking garage & exterior use.
- Specify water conservation devices including low flow plumbing fixtures such as shower heads & water sufficient toilets.
- Provide packaged, pressure booster pumps with cold water supply in high-rise buildings.
- Provide shut-off valves for all individual water risers. Ensure all shut-off valves are clearly marked and easily accessible from common corridors.
- Allow for thermal expansion of piping and equipment. Provide expansion loops or joints on all main runs and all risers. Provide a pre-manufactured expansion joint(s) for all piping when crossing the building's expansion joints. Isolate pipes to control vibrations.
- Finish piping insulation with a protective cover painted and labeled for identification.
- Provide each unit with a main water shut-off valve and ensure each hot and cold-water supply fixture within the unit has an easily accessible isolation valve.
- Provide floor drains in public and barrier-free bathrooms.
- Provide a clean-out on every floor for accessing and cleaning drainage stacks.
- Provide garbage chute wash down facilities with sanitizing and odor control.
- Recommended to use a cutter pump system within the property for sewerage.
- Recommended to use slab drop method or wall mount WC for bathrooms.
- All horizontal and vertical service ducts should be easily accessible

3.6 VERTICAL TRANSPORTATION SERVICES (ELEVATOR)

3.6.1 System Requirements

- The elevators must be equipped with a backup power system in case of power outages. The developer must also propose an air conditioning system for the elevator machine room.
- The developer is required to submit a proposal for the above-mentioned systems during the concept stage and the drawings needed for the said systems must be submitted during the shop drawings submission.
- The vertical transportation system (Elevators) is to facilitate the movement of tenants and other personnel in the building, the following must be provided: -
 - a) Passenger Elevators
 - b) Fire Elevator – must be able to accommodate a stretcher
 - c) Service elevators for commercial units
- The number of elevators can be proposed by the developer along with an elevator traffic analysis report.
- The Elevator will have the following basic function: -
 - a) Passenger Elevator - To transport people from Ground Floor to all other floors.
 - b) Fireman Elevator – to use for maintenance purpose only
 - c) Service Elevator – to use for commercial floors
- The elevators must have the following:
 - a) Speed - 4 meter per second
 - b) Type - VVVF Motor type
 - c) Operation - Group Communication
 - d) No. Of stops: depending on number of floors
 - e) Automatic rescue device (ARD)
 - f) Emergency call system
 - g) Emergency lights
 - h) Machine room with AC
 - i) Door Type - Centre Opening (Double Door)
 - j) CCTV
- At least one elevator must be PWD friendly



4. ELECTRICAL SERVICES REQUIREMENTS

This section covers the basic requirements of Mechanical & Electrical Services. Generally, the works for Mechanical and Electrical services must include, but not limited to, the following: -

- a. Cabling from the nearest STELCO transformer
- b. Air-Conditioning & Mechanical Ventilation Services;
- c. Fire Protection Services;
- d. Cold Plumbing Services;
- e. Sanitary Plumbing Services;
- f. Vertical Transportation Services (Elevator Services);
- g. Electrical Low Voltage Services;
- h. Emergency Electrical Supply (Generator Set);
- i. Communication Services comprising of: -
 1. Telephone & Internet Connection
 2. Internal Network cabling
 3. Public Address System
 4. Card Access System
 5. Elevator Access System
 6. CCTV System
 7. Automatic Barrier Gate System
 8. Guard Tour System
 9. GPON

4.1 GENERAL REQUIREMENTS

- All relevant works must comply with the requirements of local and statutory authorities having jurisdiction over
- Part/s of the works including but not limited to:
 - a) HDC – Local Council
 - b) Male' Water & Sewerage Company Pvt Ltd (MWSC) – Water and Sanitation Authority
 - c) State Electric Company Ltd (STELCO) – Energy and Power Authority
 - d) Relevant Telecom and Internet Service Provider
 - e) Maldives National Defense Force (MNDF) – Fire Protection Authority
 - f) Ministry of Environment and Energy
- The developer is required to submit a proposal for the above-mentioned systems during the concept stage and the drawings needed for the said systems must be submitted during the shop drawings submission.
- It is recommended that consultation be done at concept level with services providers of electricity, plumbing, sewerage, telecommunication, and cable TV, as to how these could be economically and sustainably incorporated into the development.
- Any space required by the relevant service provider for the installation or provision of a supporting facility (transformer, pump rooms, storage tanks, service stations, etc.) Should be provided well within the given area for the development
- Dedicated utility space at either ground or first floor level should be provided for the provision and/or installation of relevant services as required

4.2 ELECTRICAL SERVICES

4.2.1 **Regulations, Standards, and code**

The following standards, codes of practice and regulations, and any other subsequent revision or amendment must apply for all electrical works carried out in this contract.

- a. Energy and Power Authority
- b. The Regulation of the Electrical Equipment of Building
- c. Electrical Engineers, United Kingdom.
- d. The relevant British Standard Specification (BS)
- e. The British Standard Electrical Code of Practice.
- f. Local Fire Protection Authority
- g. Maldives National Building Code
- h. National Fire Protection Association. (NFPA)
- i. Maldives Civil Aviation Authority (CAA)
- j. Illuminating Engineering Society (IES) – Recommendation for lighting
- k. The requirement of Telecom and Communication Authority
- l. The latest edition of ASHRAE standards
- m. CIBSE guidelines
- n. Institute of Electrical Engineers (IEE)

4.2.2 Design considerations

- The electrical requirement shall be based on the load calculation where the power supply to be connected to the mains grid. The incoming supply shall be confirmed from the local Energy and Power Authority.
- Ensure individual revenue-grade suite metering is provided for the unit, common laundry facility, common amenity space, commercial units, and exterior use.
- Consider solar power systems for energy conservation and sustainability.
- Ensure a dedicated circuit is provided for each receptacle to avoid tripping when multiple appliances are used at the same time.
- Ensure all electrical conduits are concealed (surface mounted conduits will not be permitted).
- Provide rough-in for telecommunications equipment (computer, telephone, cable, etc.) And audiovisual (A/V) equipment in all common areas.
- Provide a rough-in box for fiber optic cable in each master bedroom (consult provider for sizes of the rough-in).
- Ensure electrical rooms are independent of all other spaces. Locate electrical rooms in one area, adjacent to other service rooms and preferably accessible by a service corridor, and as far as possible from residential units.
- Ensure that adequate ventilation is provided in transformer vaults and switchgear rooms to prevent overheating and equipment failure.
- LEDs must be provided in the following areas:
 - a. Car park area & ramp
 - b. M&E Plant Room
 - c. Staircases
 - d. Service Areas
- LEDs must be provided in the following areas:
 - a. Elevator lobby
 - b. All other common areas
- LEDs and control gear must be provided for general and functional lighting. Architectural, interior decorative and landscape lighting must be based on a proposal by respective specialist lighting consultants.
- External lighting fixtures must also be LEDs. The mounting column and fixture type must match the existing installation in the vicinity for aesthetic purpose and subject to the Architect/Landscape Architect selection.
- Separate electrical meters shall be installed for elevators, rooftop and all common area services including common lighting shall be connected to separate meter.
- Separate metering panel for commercial units and dedicated service elevator.
- Provide electrical power sockets for common areas and rooftop for maintenance purpose



- All outdoor/wet area power sockets, switches, and lights should be weatherproof
- Shaver socket and heater socket for the bathroom should be provided
- Emergency lights for all common areas, services rooms, and escape routes must be provided
- A surge protector (type 2) for all ICT equipment's must be provided

4.2.3 System Requirement

- All electrical equipment must be earthed in accordance with IEE Electrical regulation.
- Fire-rated cables will be used for essential service power according to the local Fire Protection Authority's requirement. Lighting and power system will be allocated using essential and
- Non-essential system. As for the Main switchboard, it must be designed to accommodate the different load category.
- Current local Energy and Power Authority practice and IEE Wiring Regulations must be strictly complied with.
- The emergency lighting system must consist of self-contained emergency luminaires, which must independently detect loss of normal supply and automatically switch on the integral D.C. battery supply. The lighting system must be designed by alternating circuits, grouping of lighting switches to meet the functional requirements of end-users. All external lights shall be controlled by a digital timer with the provision of manual control switches.
- All stairways, corridors, equipment rooms, and areas required by regulations must be adequately provided with exit and emergency lighting. The exit and emergency lighting must be installed to the requirements of the local Fire Protection Authority.
- The standby Generator Set should provide essential loads such as elevator, fire pump system, common area lights, access control system and booster pump system
- All the necessary safety and protection devices must be installed to meet the Local Authority's requirements.
- An emergency accessway must be illuminated at all times from the essential supply to meet Local By-Laws. Emergency exits must have Exit Lights fitted for safe evacuation during emergencies.
- To meet local MNDFs requirements, self-contained emergency lights must also be provided to escape staircases.
- Earth leakage protection and miniature circuit breakers must be installed to ensure that maximum safety and convenience of maintenance is afforded to every DB's.
- For the overall safety of the installation, efficient electrical earthing and lightning protection systems must be installed.

a) Lighting

- The illumination levels must be generally in accordance with the IES Code of Practice, CIBSE Code for Interior Lighting and Lighting Guide 3 (LG3), and current practices.
- The lighting system must be designed by arrangements of alternating circuits and selective grouping of light switching to achieve multi-levels of illuminance.
- A daylight harvesting system must also be incorporated into the design to maximize the use of sunlight while minimizing energy consumption.

b) Self-contained Emergency Lighting

- Self-contained emergency lighting of 3 hours' duration must be designed to local Fire Protection Authority's requirement.
- The self-contained emergency lights during the mains healthy condition would operate from the main supply while simultaneously charging the battery.
- During a main power failure and the Gen Set supply failure, the same lamp while is utilized except that it would now operate from the battery.

- When the mains supply and or the Gen Set supply resume, the lamp would revert to normal operations from the main supply and or the Gen Set supply.

c) Exit Sign

- These self-contained types Exit Sign with standby batteries and automatic charging facilities will be provided.
- During mains healthy condition, it would operate using the main supply, whilst during the Main power failure and the Gen Set supply failure, they will operate using the built-in battery.

d) Earthing System

- Earthing system must be installed in accordance with the requirement of BS Code of Practice CP 1301, IEE Wiring Regulation (16th Edition) and Rules and Regulations of local Energy and Power Authority.
- The earthing system must comprise of neutral point earthing, copper tape interconnections, and earth electrodes.
- A separate power system must have a common earth connection.
- Each of the systems below should have its dedicated earthing system meeting their respective earthing requirements: -
 1. Electrical system
 2. Equipment frame
 3. Telecommunication system
 4. Lightning protection system
- With the exception of Telecom's system, the rest must be integrated by linking them with buried bare copper conductors of appropriate size. The purpose is to bring the earth resistance of the entire system to a lower value under the constraint of space available for the discharge of electric current to the ground.
- Telecom system should be isolated from the integral system as far as possible to avoid the transfer of potential to Service Provider's electronic equipment and the telecommunication system.

e) Lightning Protection System

- To ensure safety to the building and its occupants if lightning happens to hit it directly, lightning protection must be proposed.
-
- This proposal must be submitted during the concept stage and drawings must be submitted with the detail design submissions.

4.3 COMMUNICATION SERVICES

4.3.1 Assumptions / Design Criteria

- Card Access System will be provided to every residential level.
- Elevator Access System will be provided to every elevator.
- CCTV system must be using Dome/Bullet IP Camera capable to record HD Video and Audio
- GPON fibre optics cables must be provided to each unit & services stations wherever required.

4.3.2 System Description

a) Building Access Control

- The access control system uses RFID Cards as a medium of access.

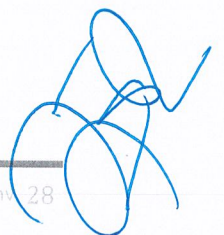
- All authorized tenants must carry their RFID Card at all-time, otherwise will be treated as a visitor.
- A visitor will be issued with a visitor card and entry should be accompanied by authorized personnel.
- Any forced entry will be noticed with an alarm to access the control room/security room.
- **Common Area Access** – all the tenants/authorized person should be able to access the common area of the building by using an RFID card.
- **Elevator Access** – this enhances the overall security of the building by restricting tenant access to their respective floors only

b) CCTV System

- The CCTV system must be designed to provide 24 hours' video recording facility at Security Control Room for individual cameras installed in the building.
- Cameras must be provided at the entrance guardhouse and entrance lobby point, which will be connected to a recorder and TV monitor.
- The CCTV system must be able to capture the surrounding area, perimeter, entrance elevator lobby, car parks.
- All activities within the premises & perimeter surrounding to keep track and recorded for playback if necessary.

c) Carpark Barrier Gate System

- The developer must propose a car park barrier gate system near the entrance to the car park consisting of:
 1. Controller
 2. Ingress/egress barriers
 3. Access card reader
 4. Manual switch



5. References

- Australian Government, AusAID. (2013). *Accessibility Design Guide: Universal design principles for Australia's aid program*. Australian Government, AusAID.
- Communities and Local Government. (2010). *Code for Sustainable Government - Technical Guide*. London: Department for Communities and Local Government.
- ECONOMIC COMMISSION FOR EUROPE - Geneva. (2006). *GUIDELINES ON SOCIAL HOUSING - Principles & Examples*. United Nations, Geneva, Switzerland.
- Government of Ireland. (1999). *Social Housing Guidelines - Design Guidelines*. The Stationary Office.
- (n.d.). *How Affordable is Affordable Housing?* Zell/Lurie Real Estate Center.
- London, M. o. (2006). *Housing Space Standards*. London: HATC Limited.
- Mayor of London. (2010). *London Housing Design Guide - Interim Edition*. London Development Agency.
- Myerson, D. L. (2007). *Environmentally Sustainable Affordable Housing*. Urban Land Institute.
- Queensland Government. (2007). *Crime Prevention through Environmental Design*. The state of Queensland.
- Region of Peel. (2014). *AFFORDABLE HOUSING ACTIVE DESIGN : Guidelines and Standards*.
- Region of Peel. (2015). *AFFORDABLE HOUSING DESIGN: Guidelines & Standards for Apartment Buildings*. Region of Peel.
- The City of New York. (2018). *Designing New York: Quality Affordable Housing*. NYC Public Design Commission.

