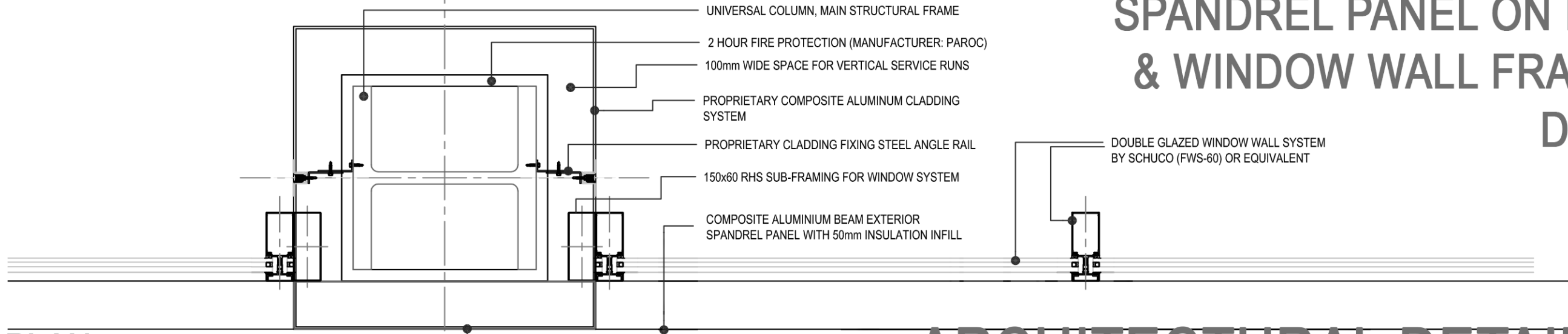


ELEVATION

SPANDREL PANEL ON BEAM & WINDOW WALL FRAMING DETAIL



PLAN

ARCHITECTURAL DETAILING

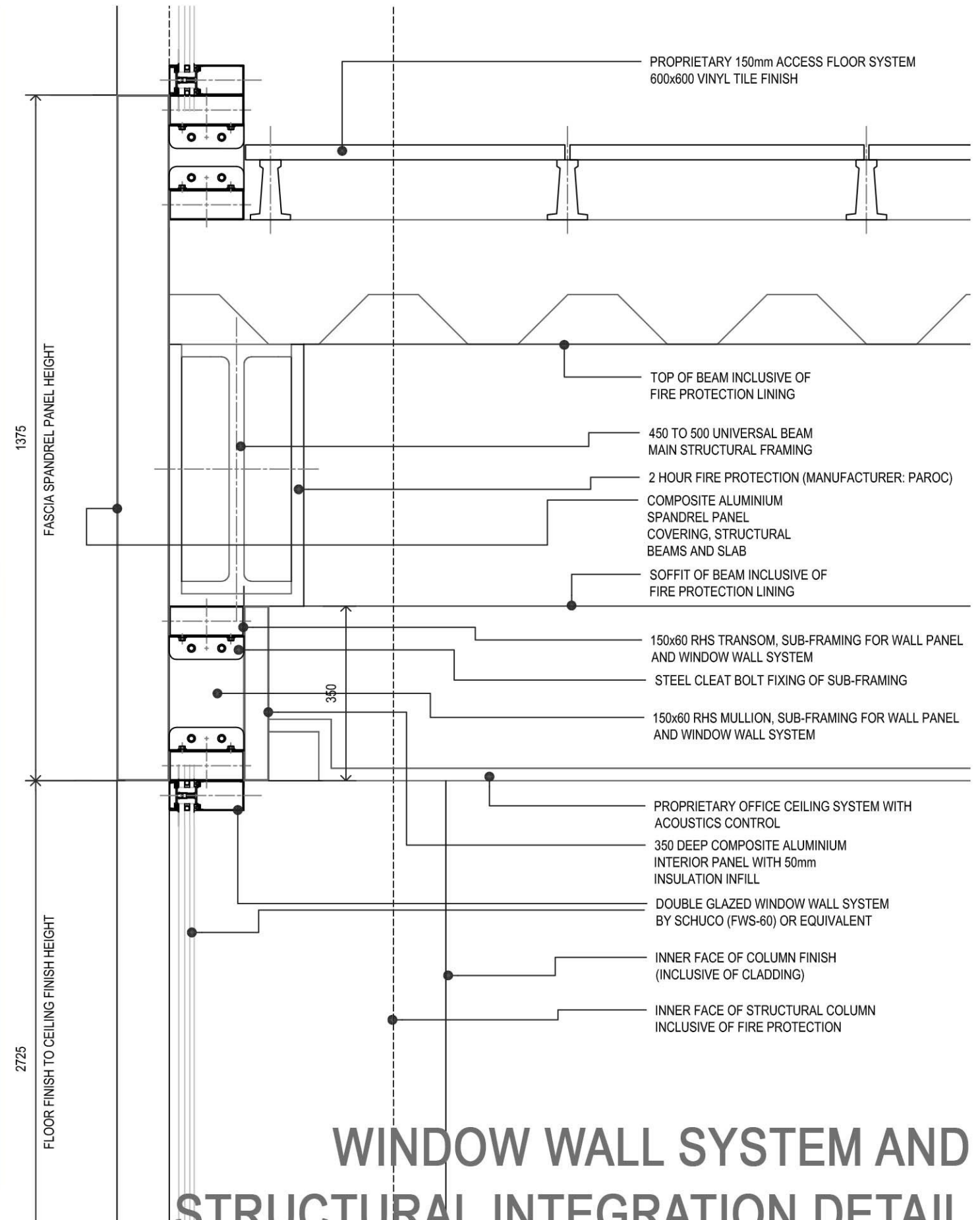
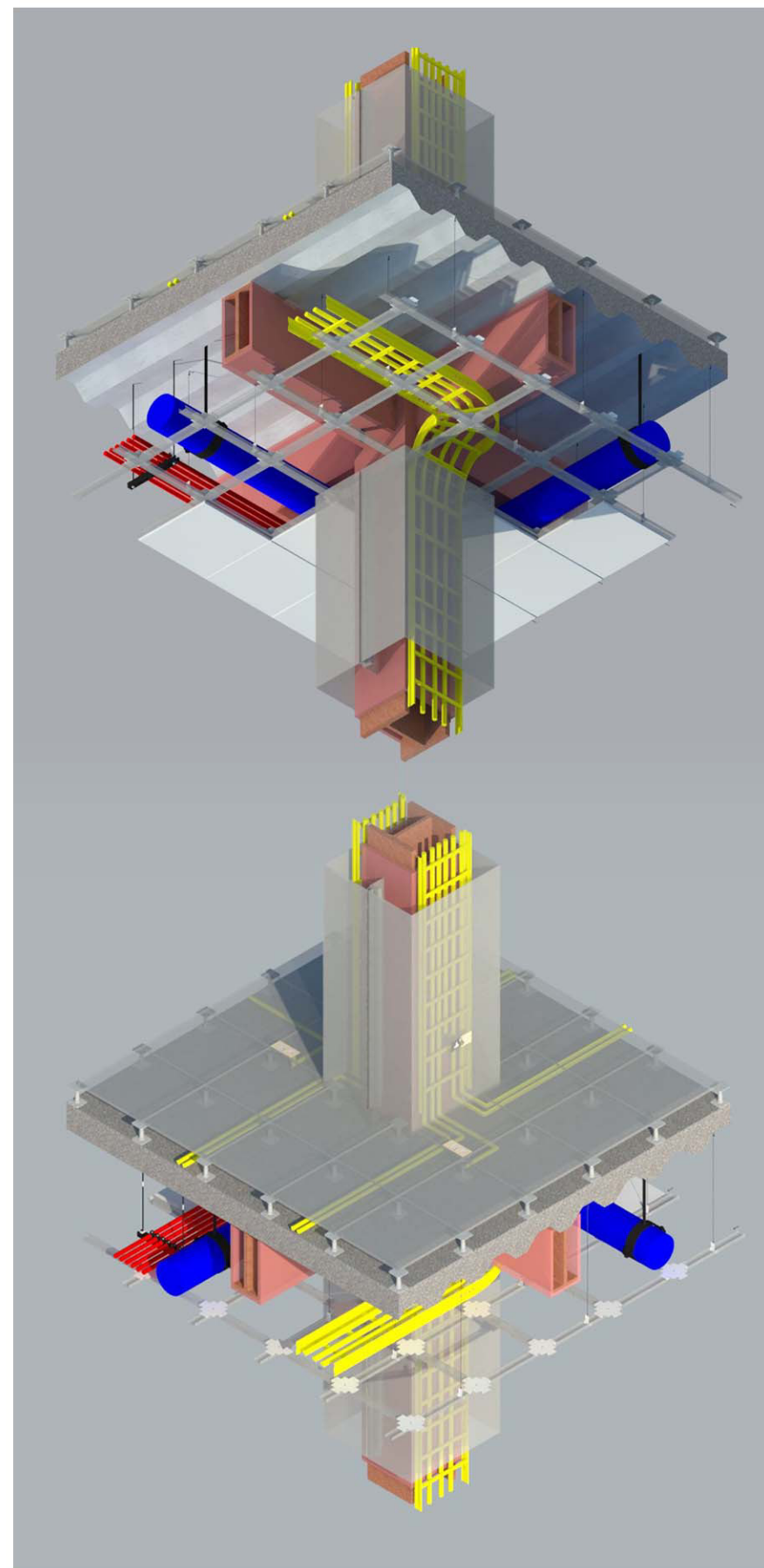
PROPOSED 6 STOREY OFFICE BUILDING AT HULHUMALE'
CLIENT: MINISTRY OF NATIONAL PLANNING AND INFRASTRUCTURE

DESIGN CONSULTANCY: GEDOR CONSULTING PRIVATE LIMITED
DATE: 10/04/2019

HORIZONTAL SERVICING
THROUGH CEILING
SPACE

VERTICAL SERVICING
THROUGH CLADDING
SPACE

IT, ELECTRICAL AND
POWER SERVICING
THROUGH RAISED
ACCESS FLOOR
SPACE



WINDOW WALL SYSTEM AND STRUCTURAL INTEGRATION DETAIL ARCHITECTURAL DETAILING

CONCEPT FOR SERVICES AND
STRUCTURAL INTEGRATION
PROPOSED 6 STOREY OFFICE BUILDING AT HULHUMALE'
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CIVIL AND STRUCTURAL ENGINEERING STRATEGY

PROPOSED 6 STOREY OFFICE BUILDING AT HULHUMALE'
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6.0. Design parameters

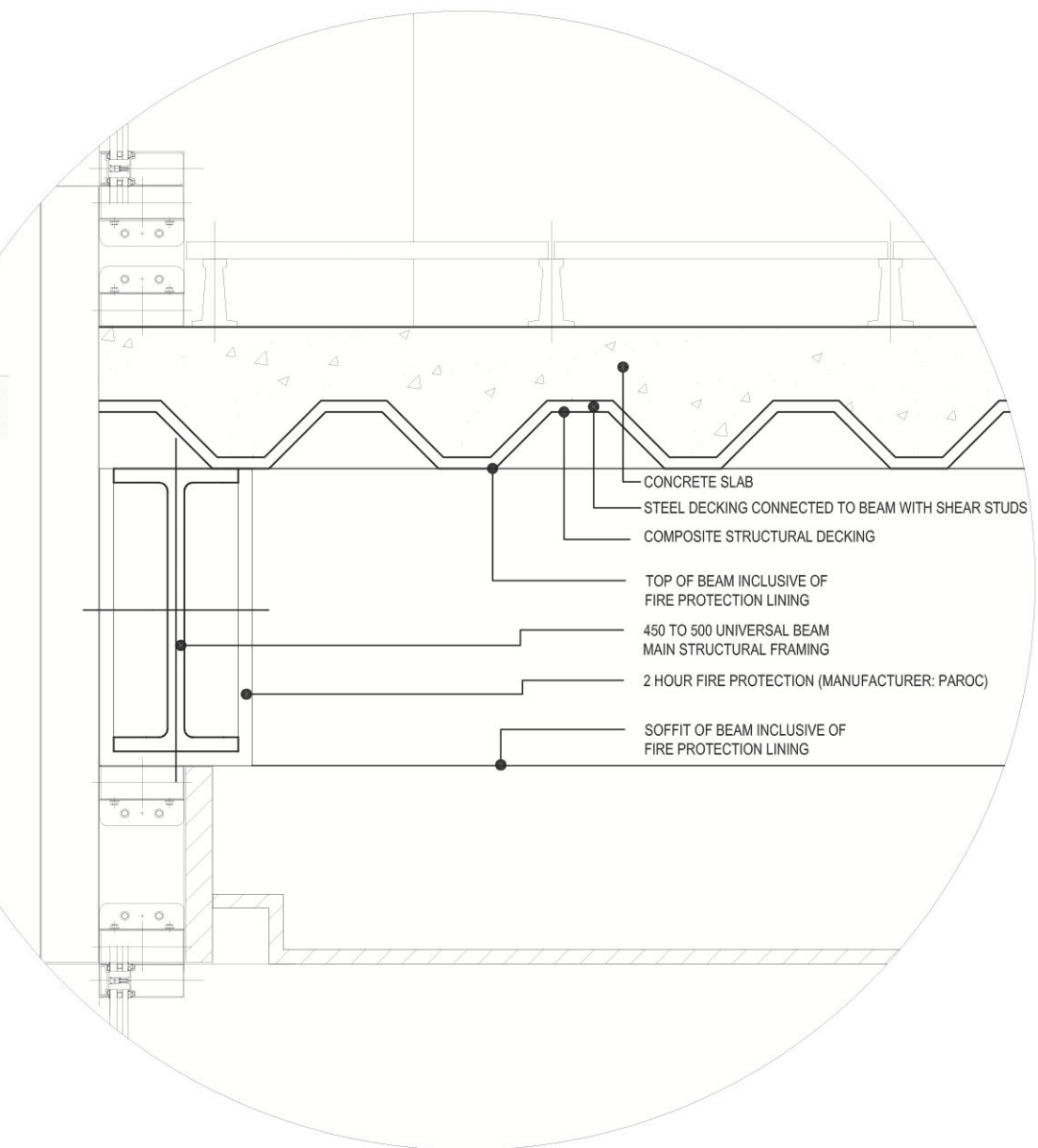
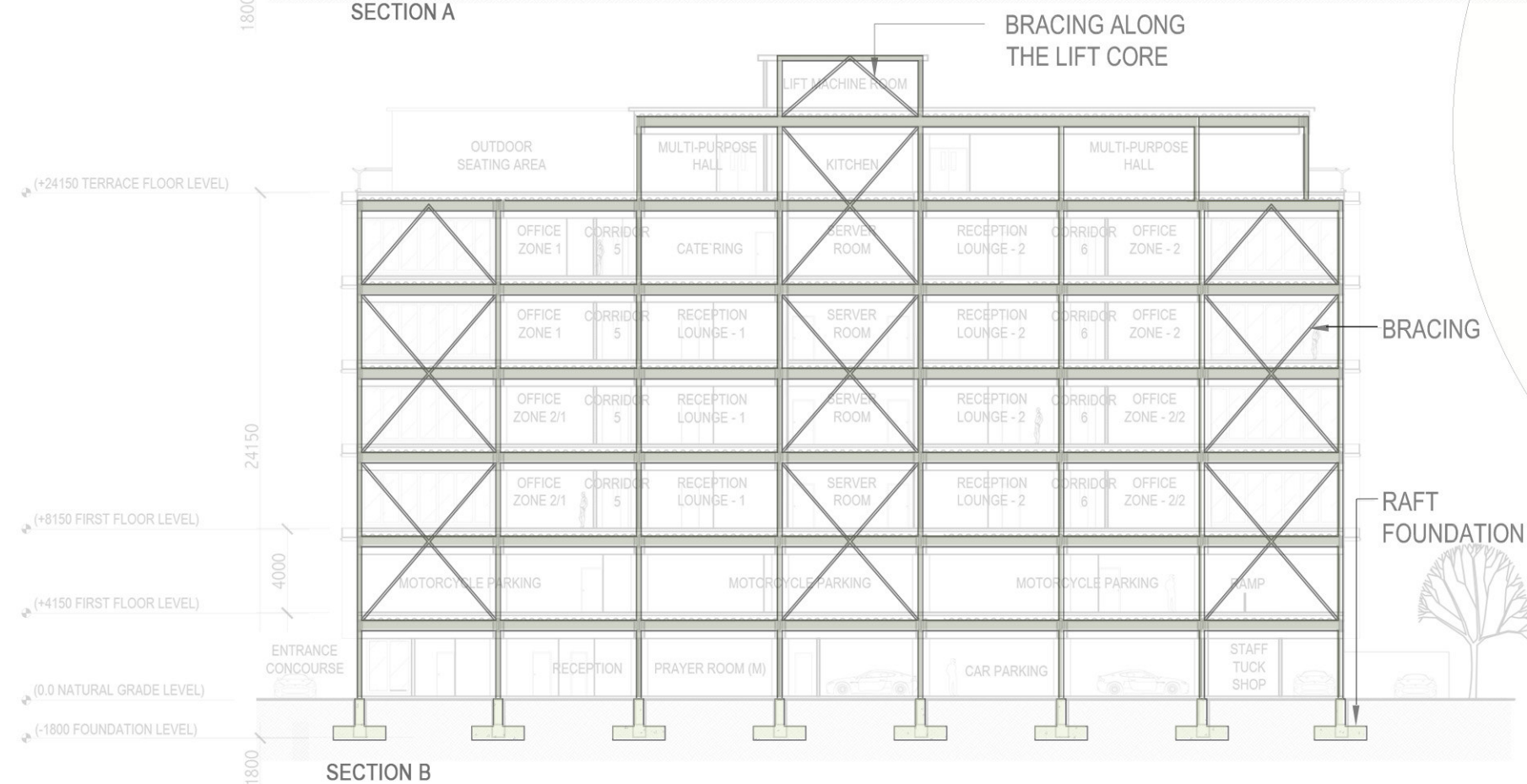
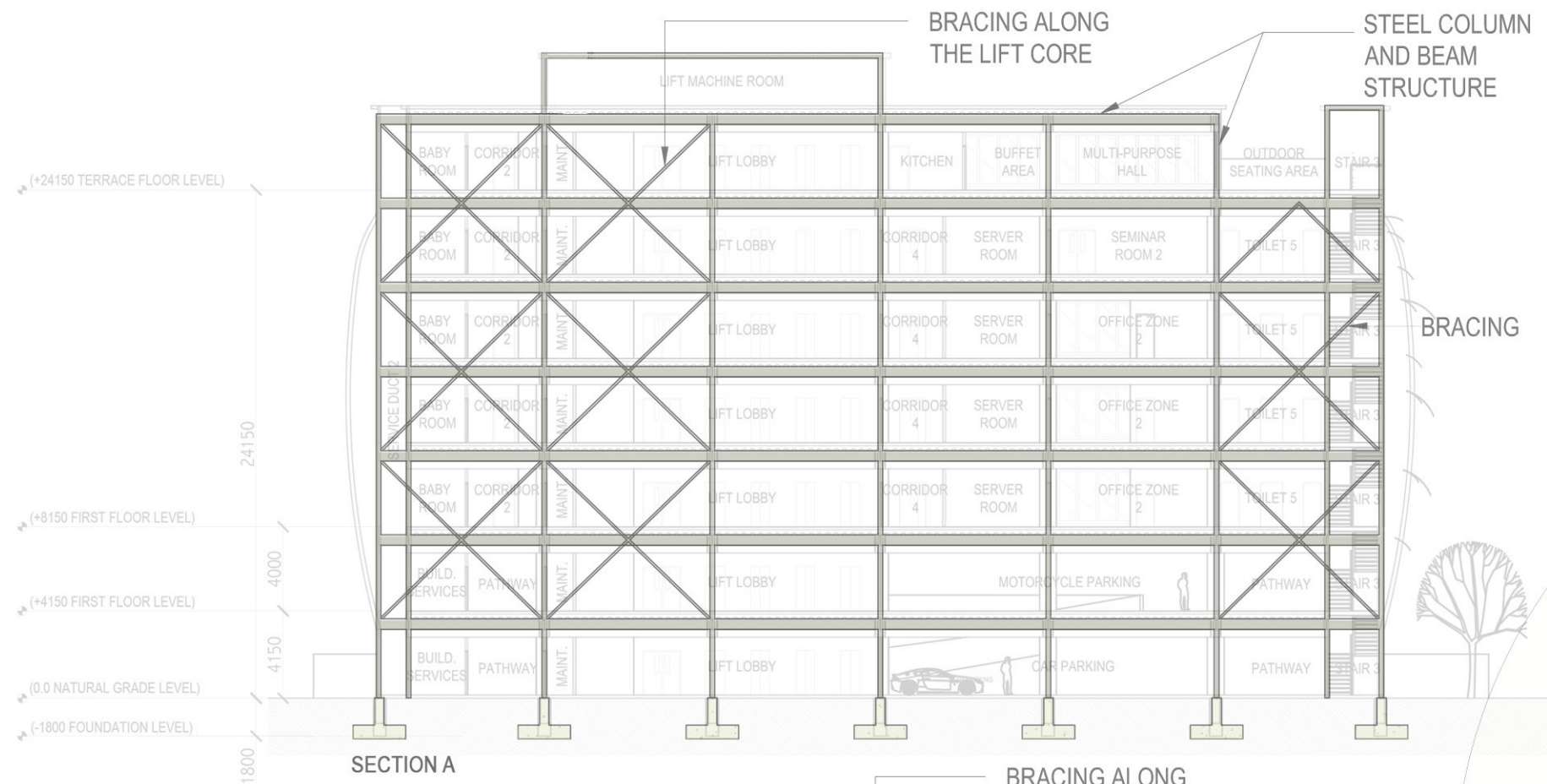
In detailed design stage, these are to be verified and amended where necessary and developed further, in consultation with the client.

Number of floors	Ground + 6 (or 6 + Roof Level)
Shape of the building	Square
Building height (m)	30150.00m
Foot-print area (m2)	2256.00 m²
Total floor area (m2)	15792.00 m²
Construction type	Reinforced concrete foundation and substructure as well as concrete lift and stairwell core. Steel column and beam frame and steel-concrete composite floors.
Loads considered	Dead, Live and Wind. (if deemed necessary, include seismic loading in detailed design)
Basic wind speed	ULS = 22 m/s
Terrain category	Close to the coastline. Plain terrain
Wind pressure coefficients (general)	These coefficients are for a 10 storey building and typical to most locations and conditions in Maldives. TO BE VERIFIED IN DETAILED DESIGN Cpe (windward) = +0.7, Cpi = -0.1 Cpe (Leeward) = -0.5, Cpi = +0.2 Cpe (Crosswind); (windward) = +0.7, Cpi = -0.1 (Leeward) = -0.5, Cpi = +0.2 Cpe (Roof) = -0.9, Cpi = +0.2 (only for the stair roof, if recommended) Cpe (Side) = -0.65, Cpi = +0.2
Building deflection limits	Column at top / 500, frame spacing / 200, floors beams and joists / 300
Unit weight of concrete	24 kN/m³ (should consider light weight concrete for the composite floors)
Unit weight of wall panels	Wet areas, masonry blockwork 17 kN/m³ Dry Walls EPS Pannels 1.25 kN/m³
Unit weight of floor screed and finishes	Light weight screed for better thermal performance and lighter loading conditions. Acoustic underlay may be considered as well. Include for floor finishes 11-12 kN/m2
Compressive strength of concrete (fc)	40 N/mm² for foundation, lift core, stairs and substructure. 25 N/mm2 for light weight concrete composite floor.

High yield deformed steel	460N/mm² or higher
Mild steel if used for stirrups	250 N/mm²
Concrete covers	Slab = 27-30 mm, beam = 35mm, column = 40mm,
Structural steel	Hot rolled galvanized universal steel sections, grade S275/S355 as per BS 5290
Foundation System	Full raft foundation with inverted beams or flat slab.
Foundation soil	Loose to medium gravel, typically found in Hulhumale. But geotechnical investigation by means of boreholes and plate bearing test is recommended.
Soil bearing capacities	SBC (Assumed) = 150kPa (to be determined by geotechnical investigation)
Live load for office areas	3.0 kN/m² for general office space. Other areas ^{to} be verified in detailed design. Live loads for banking, libraries, paper storage, IT equipment, batteries will be higher.
Parking	Car parking: Ground Floor Motor cycle parking: 3 kN/m²
Recreational and commercial areas	5 kN/m²
Live load on roof terrace, stairs and balconies	3 kN/m²
Dead load (including screed and tiling)	To be determined based on type of screed, raised floors, finishes etc
Dead load from walls	Varies for types of wall
Load combinations	1.4G+1.6Q 1.4G+1.4 ΨI 1.2G+1.2Q+1.2 ΨI

7.0. Structural Analysis

Structural analysis and Design will be done based above data, using comprehensive modeling software or combination of software and structural member design sheets are typically used for designing of individual members. Detailed design will be performed on the result of analysis.



DETAIL OF STRUCTURAL COMPOSITE DECKING

STRUCTURAL ENGINEERING SCHEMATICS

PROPOSED 6 STOREY OFFICE BUILDING AT HULHUMALE'
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BUILDING SERVICES ENGINEERING STRATEGY

PROPOSED 6 STOREY OFFICE BUILDING AT HULHUMALE'
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Building Services for Office Building

Following are the Mechanical, Electrical Fire Alarm and Fire Fighting system Building Services facilities that are proposed for the development.

Electrical Services

1. Electrical Power System

Electrical System shall be designed as per Maldives Energy Authority's Regulations.

A high tension power cable (11KVA) will supply power to the building. A step down transformer shall be sized and shall be installed on the ground floor of the building that will supply Low tension power to the main distribution board.

The main distribution board will have all the Kilo Watt Hour meters and main breakers to all the floor feeders. The proposed schematic design will show the buildings power plan for the whole building. This main distribution system shall be designed to accommodate incoming solar power harnessed from the roof top PV panels.

Emergency generator set housed on the ground floor will provide power to all essential power that includes; main lobby area, all lift lobbies, lifts, car park ventilation, limited car park lighting (25% of the car park lighting), limited terrace lighting & power for CCTV system and security systems.

Each office space on every floor shall have two distribution boards one for the lighting system and one for the power system (socket outlets). The power distribution boards will supply power to all the socket outlets inside the office space via a sub distribution boards. Furthermore, all the indoor and outdoor air- conditioner units shall be powered from the power distribution board.

The building shall have an emergency generator to cater critical loads such as lifts and public area lighting. Generator should be connected to the main distribution panel via automatic transfer switch. Emergency generator and change over system shall be designed to power the critical load within 20s of a mains failure.

2. Electrical Lighting System

All the building lighting system shall be designed to the specified lighting level as shown on the Shell and Core Schedule. The lighting system for each of the office space shall be controlled by lighting control system. This lighting controller shall have the capability to have individual lighting controls to be installed in individual office cubical.

3. CCTV System

The building shall have a high quality Closed Circuit Television (CCTV) system for surveillance of all public spaces, corridors, and parking areas. The CCTV systems shall have IP cameras and video management system connected to building's data network's security VLAN.

4. Lightning Protection System

Lightning Protection system shall be designed as per Maldives Energy Authority's regulations. Lightning Protection system shall consists of Early Streamer Emission (ESE) air terminal(s) mounted 2m above terrace roof. Down conductor shall run vertically down on a side of the building to a test pit. Down conductor shall be connected to the grounding electrodes via a test clamp.

Mechanical Services

The mechanical services in the building shall be designed to follow the industry standards as follows:

Maldives National Building Code Handbook 2008

CIBSE Guide

NFPA and ASHRAE Standards.

ANSI/SMACNA Standards

The following will be provided as minimum mechanical systems for the building:

1. Lifts

This office building is designed to have 7 passenger lifts, with each lift's carrying capacity of 12 passengers and the machine room located on the terrace. The specified speed of each passenger lift shall have a minimum of 90m/minute. Two lifts shall be designated as fireman lifts. All the lifts shall have the standards operating features, ventilation fans and emergency lights and Automatic Landing Device and door openable device during power failure.

Goods lift shall be able to carry a maximum weight of 1000kg to all the 6 floors and the machine room located at the terrace level. The interior of the goods lift shall be finished with padding material to protect the lift walls.

All the lift machine rooms shall be air-conditioned and the lift machine room door shall be air tight and should be lockable from outside.

2. Air Conditioning & Mechanical Ventilation System

The building will incorporate the following Air-conditioning and mechanical ventilation systems:

- Ventilation systems
 - Supply of conditioned or heat reclaimed air into office space as required by ASHRAE 62.1 2007 minimum ventilation requirement for buildings.
 - Exhaust systems to extract air of class that is not to be recirculated.
- Air Cooling and conditioning systems to serve comfort cooling as well as functional cooling required for the building.

For the purpose of operations, monitoring and control, the ACMV system will be divided to roughly four equal zones in each floor of the building. This will help both in power monitoring, operations and in maintenance, because different zones can be isolated and inspected separately.

A centralized but modular VRV system will be used for all cooling purposes of the building. The modular nature of VRV system will enable clustering the system, to dedicate them to different zones of the large floor area of the building. This will enable interchange of systems and use of same and similar spare parts and redundant equipment during maintenance, as priority and use arises.

Zoning of ACMV system also will enable the building owner to meter and monitor the electrical power consumption of the whole system for each zone separately.

Each of the four zones for each floor will be served by separate dedicated Fresh air processing units and or heat reclaimed ventilation (HRV) units, which will provide the required minimum amount of fresh air to eliminate stuffiness that are normally felt in cooled office spaces without fresh air supply. Supply of fresh is important because it will reduce sick building syndromes by diluting pollutants generated inside.

Installation of HRV will enable reuse of energy from exhausted air to be used to cool supplied fresh air as part of building ventilation system.

The air conditioning system shall be designed to maintain the office air temperature of 24 deg C & relative humidity to be less than 65 percent. Individual office compartment of every single floor shall have different sets of VRV system and the power for these units shall be connected for the respected electrical DB.

Ventilation will be provided by Air processing units and or HRV units dedicated to each air-conditioning zone. Air Grilles shall be sized to minimise static pressure loss across the grille (ideally maintaining below 10Pa) while distributing air at a throw of no less than 4m at an acoustic performance of <30dBA.

Cooling of all areas will be from direct expansion type ceiling mount cassettes easy filter cleaning and easy installation. For ball room and other grand areas ceiling concealed duct type can be recommended. All the indoor units shall be able to be controlled individually and together from the individual office space. Selection of indoor units will be based on interior requirement with relevance to air throw for proper and even distribution of cool air.

All dedicate server rooms or critical electronic equipment rooms requiring rack-wise cooling, will be provided with precision air-conditioning system.

Both indoor and outdoor units operations will be monitored by the building Energy Management System which can alarm maintenance personal incase of breakdowns and service requirements.

All the toilets shall be mechanically ventilated at and time shall have minimum of 10 ACH. All the four escape staircases shall have roof mounted air supply system to be operated during any fire alarm. The stair case shall be pressurized to 1.2 bars.

Ducts will be insulated to prevent condensation forming within the ceiling void and to minimize noise.

All the lift machine rooms shall be air-conditioned and shall be maintained at 24 degrees C.

3. Fresh Water System.

The codes used for the detail design of the Water Supply System Shall be:

1. BS EB 806 - 1-5:2010
2. BS EN 1717: 2000

Mains connection to the building will be via MWSC network. The Utility provider's supply pipe will be directly connected to booster pumps via inlet manifold to increase pressure of the system. The booster pumps will then directly supply the pressurized water to outlets via individual risers connected to outlet manifold.

It is proposed to use at least two separate potable water risers for each floor when considering the large floor area of the office building. Apart from this, a separate line will also be provided for each proposed food and beverage spaces. This will enable separate metering of water supply systems.

A separate pipe work including risers, shall be provided to supply water to all the WC flush tanks. This separation will enable the owner to use recycled or other non-potable water sources as flushing water. The source of water for flushing is mainly from the harvested rain water stored in underground water tanks or wells embedded underground.

BUILDING SERVICES REPORT

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All potable water pipes shall be of PP-R type and all pipe used for non-potable cold water shall be PVC pipe.

4. Sanitary System

The codes used for the detail design of the all sanitary system shall be BS EN 12056-2:2000.

All waste water from the development shall be driven by a gravity drainage system to the below ground drainage network. The below ground network will consist of UPVC pipe and shallow ICs for inspection purposes. All liquid waste will eventually be collected to the MWS junction located in the plot boundary.

A two pipe system will be proposed for the building. Separate waste pipes shall be provided to all sanitary fittings within kitchen, utility room, toilets and shower rooms. Waste branch pipes shall be connected to vertical soil vent pipes (SVP) which will descend directly down to connect either to the below ground drainage system or a sump pump. The heads of the SVPs shall be complete with Air Admittance Valves (AAV) to allow air into the system when negative pressure occurs or shall terminate to atmosphere complete with roof cowl. A roof cowl termination shall be incorporated as the preferred option.

All food production area waste connection will be provided with grease traps of adequate capacity to filter out oil and grease before reaching the MWS main junction.

5. Fire Fighting System

The codes used for the detail design of the all fire protection system shall be:

1. MNDF local requirements.
2. NFPA 72 or BS EN 54 for fire detection and alarm system.
3. BS EN 671 for hose reel system
4. BS 5041 for wet and dry riser systems

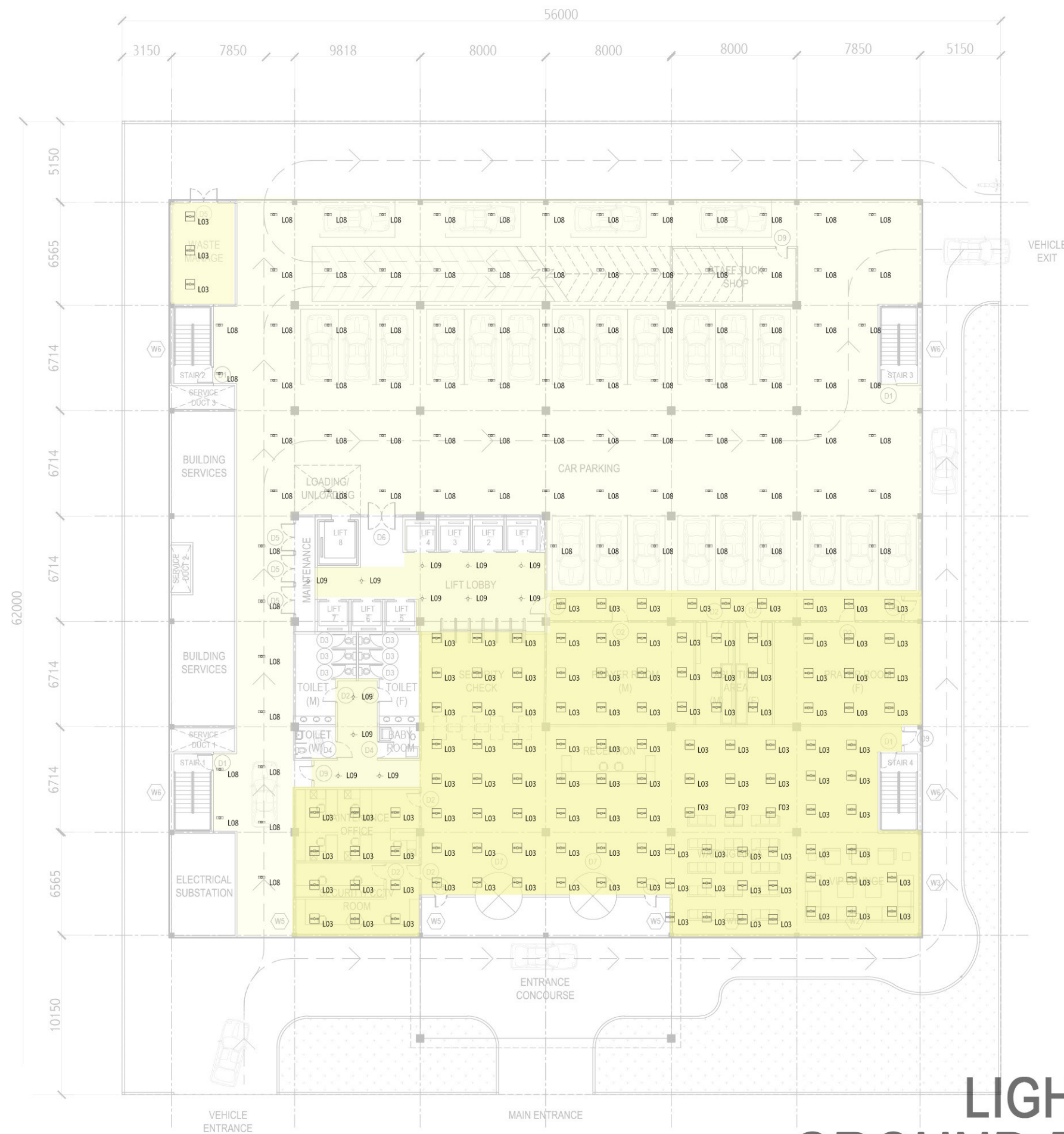
The fire detection and firefighting systems will be designed to the standard required by MNDF fire department. As such the following systems will be provided:

- A dry riser system consisting of 4 numbers of dry risers, each connecting 2 landing valves to each floor.
- A hose reel system consisting of 4 stand pipes and 4 hose reels in each floor.
- A fully addressable digital or analogue fire detection and alarm system with 4 dedicated zones in each floor.

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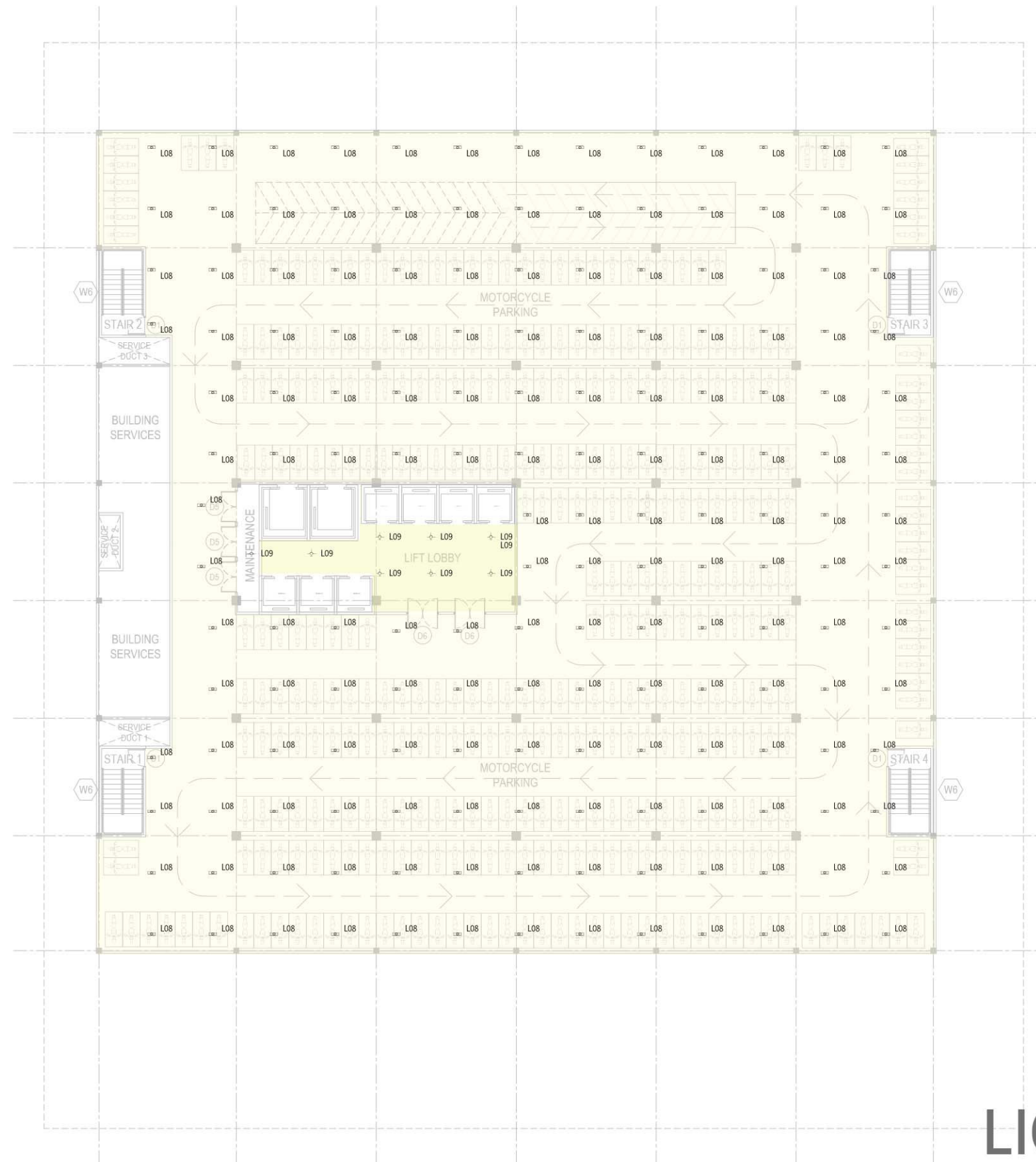


LEGEND		
SYMBOL	GEDOR CTLG NUMBER	DESCRIPTION
	L03	CEILING RECESSED, LOUVERED LUMINAIRE WITH 5400LUMEN OUTPUT @ 5500K
	L08	2X36W FLUORESCENT LAMPS IN CEILING RECESSED, LUMINAIRE WITH FLAT DIFFUSER
	L09	SURFACE MOUNT DECORATIVE LUMINAIRE WITH 2000LUMEN OUTPUT @ 5500K

LIGHTING LAYOUT GROUND FLOOR PLAN

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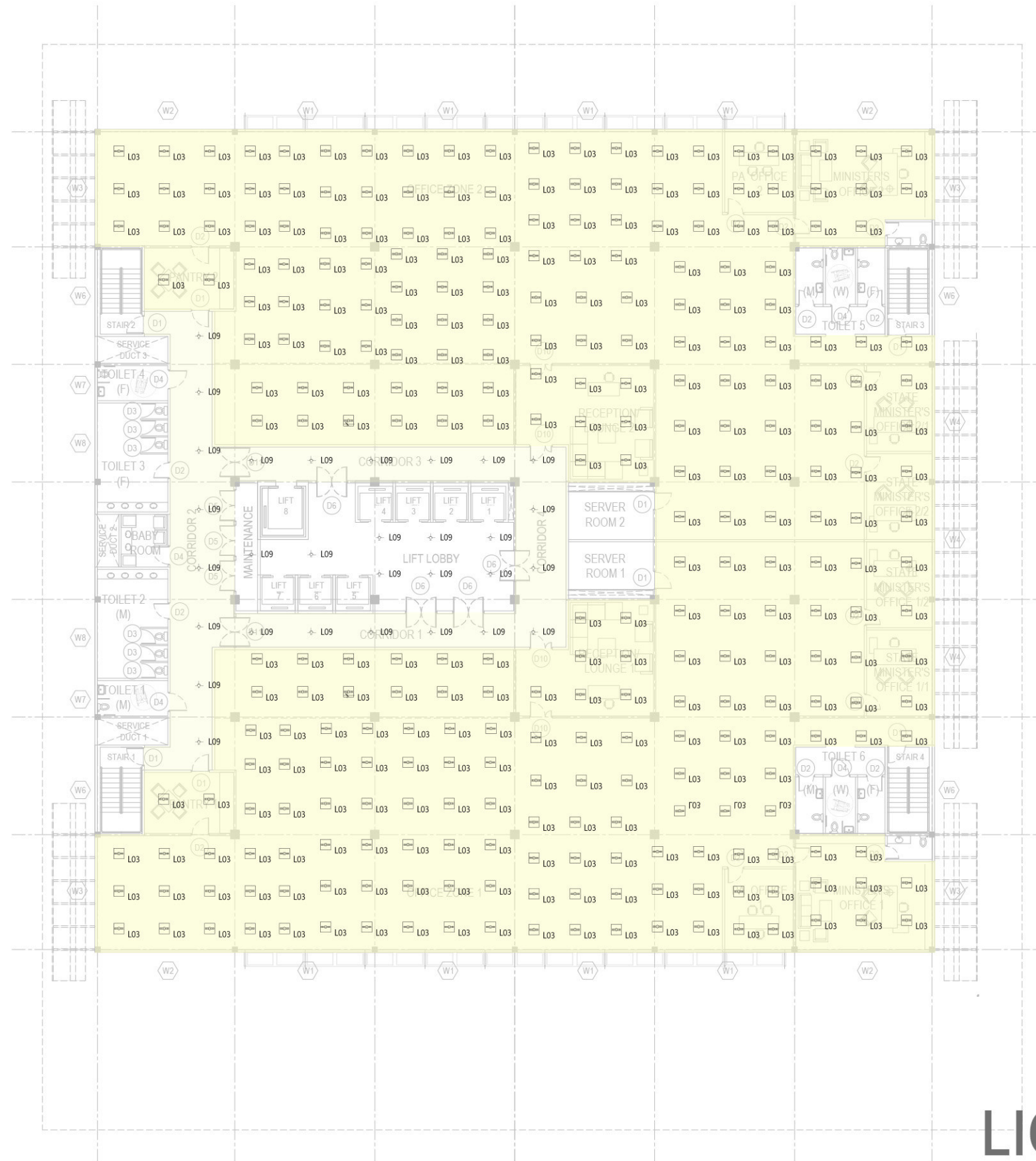


LEGEND		
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	L08	2X36W FLUORESCENT LAMPS IN CEILING RECESSED, LUMINAIRE WITH FLAT DIFFUSER
	L09	SURFACE MOUNT DECORATIVE LUMINAIRE WITH 2000LUMEN OUTPUT @ 5500K

LIGHTING LAYOUT FIRST FLOOR PLAN

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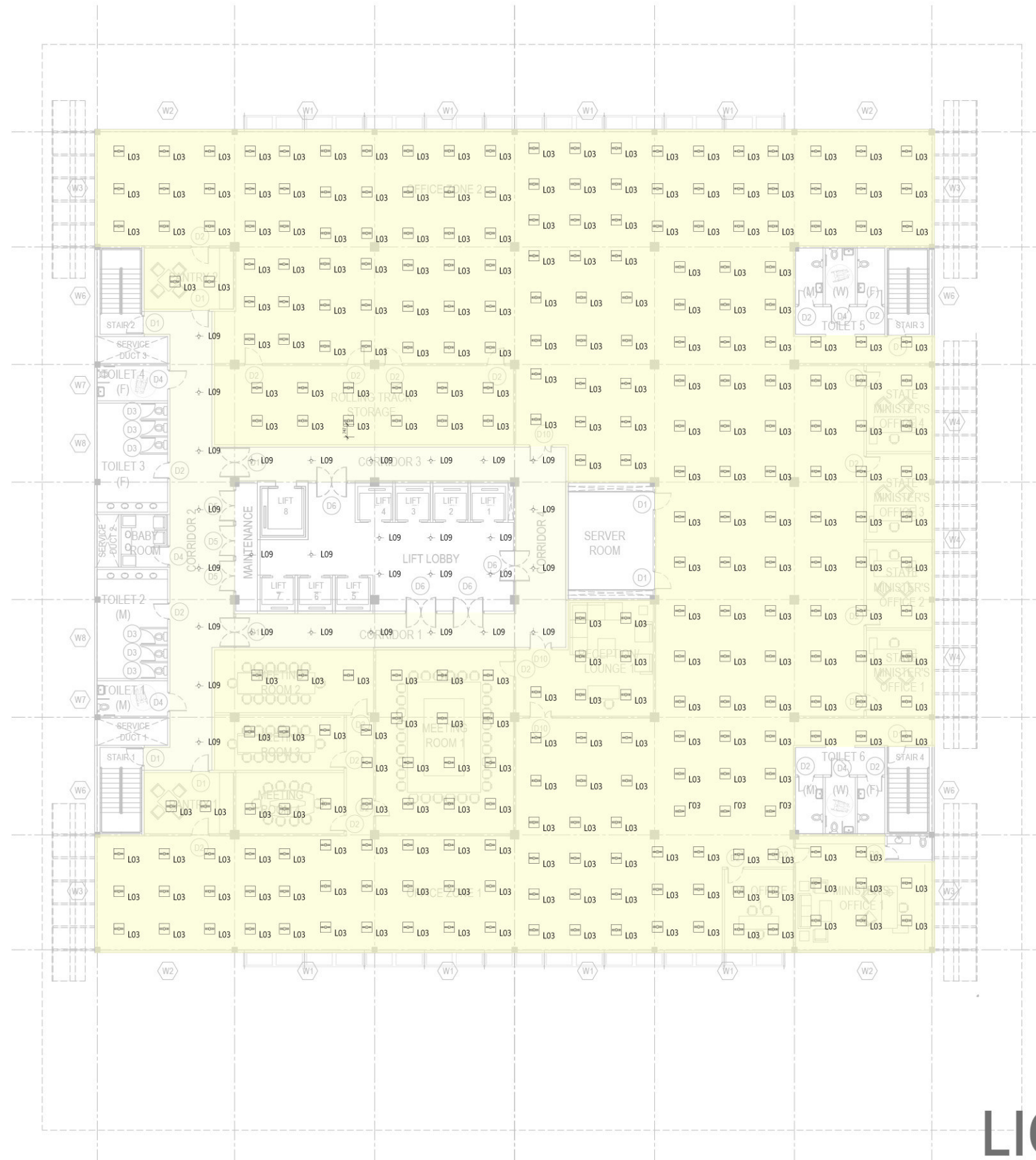


LEGEND		
SYMBOL	GEDOR CTLG NUMBER	DESCRIPTION
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	L09	SURFACE MOUNT DECORATIVE LUMINAIRE WITH 2000LUMEN OUTPUT @ 5500K

LIGHTING LAYOUT SECOND AND THIRD FLOOR PLAN

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	L09	SURFACE MOUNT DECORATIVE LUMINAIRE WITH 2000LUMEN OUTPUT @ 5500k

LIGHTING LAYOUT FOURTH FLOOR PLAN

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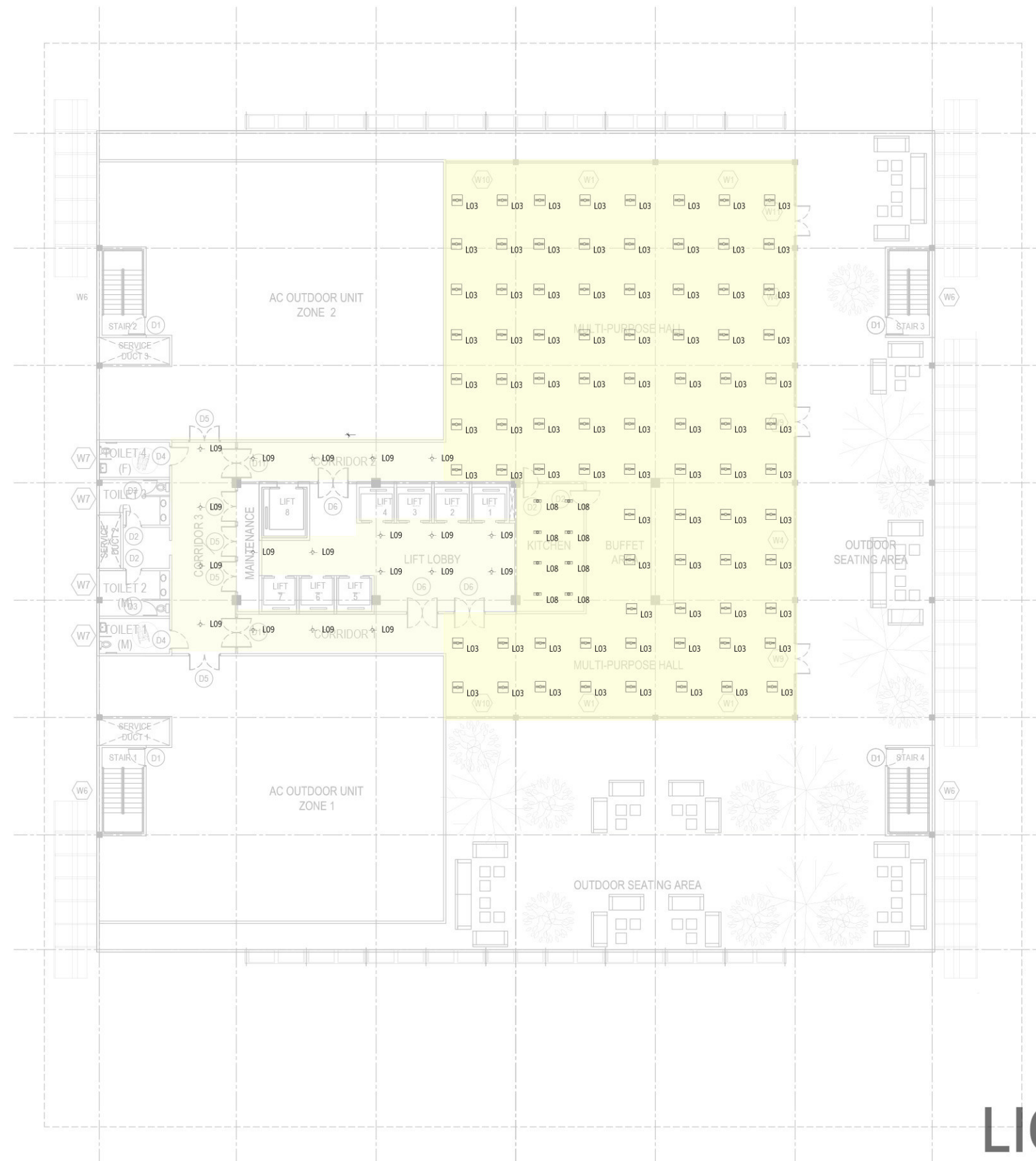


LEGEND		
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	L09	SURFACE MOUNT DECORATIVE LUMINAIRE WITH 2000LUMEN OUTPUT @5500K

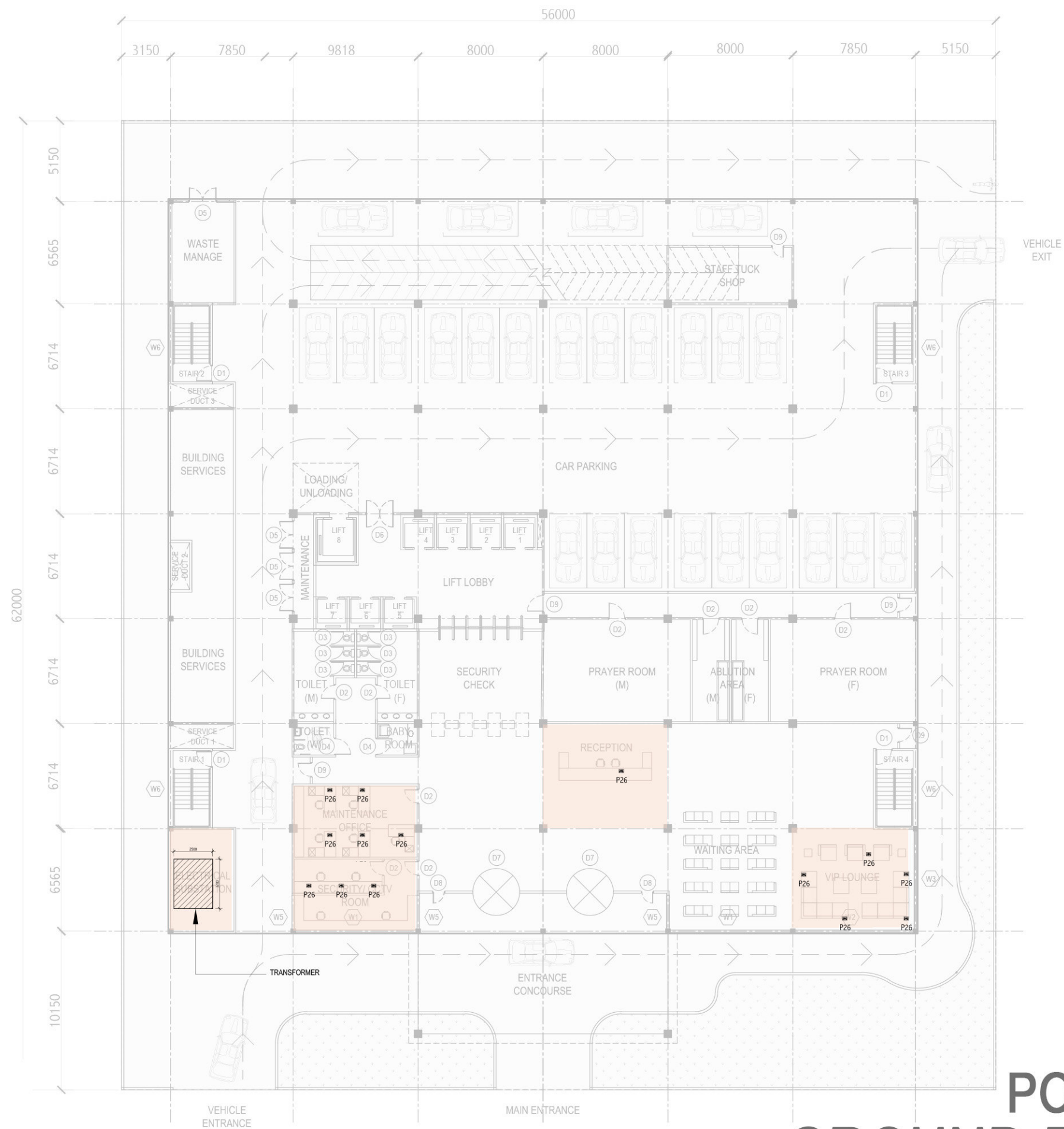
LIGHTING LAYOUT FIFTH FLOOR PLAN

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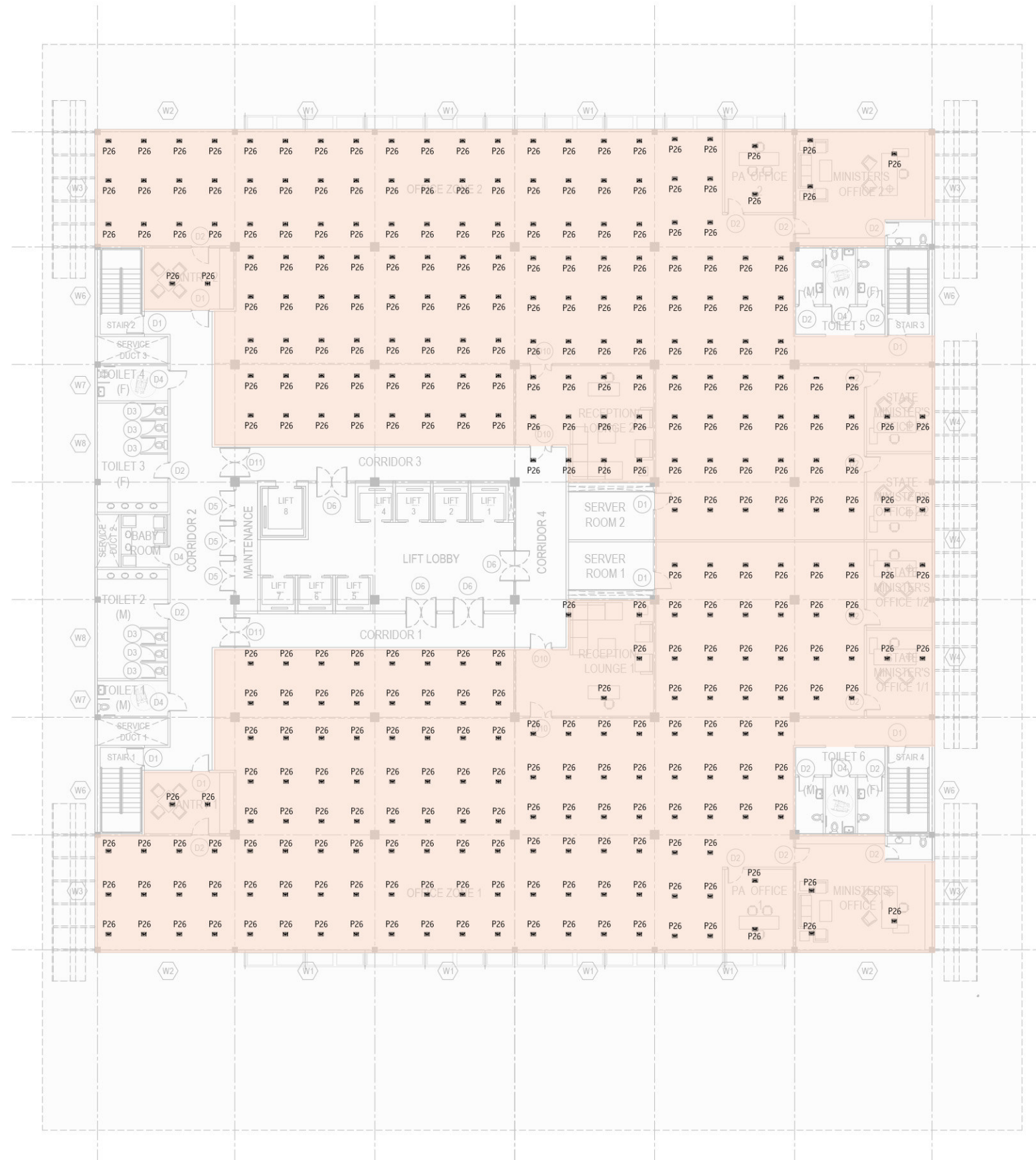


LEGEND		
SYMBOL	Gedor Ctlg Number	DESCRIPTION
	P26	FLOOR CONCEALED MULTIMEDIA OUTLET CONSISTING OF 2GANG 13A SOCKET, R111 AND R145 FEMALE CONNECTORS
	P28	WALL CONCEALED MULTIMEDIA OUTLET CONSISTING OF 2GANG 13A SOCKET, R111 AND R145 FEMALE CONNECTORS

POWER LAYOUT GROUND FLOOR PLAN

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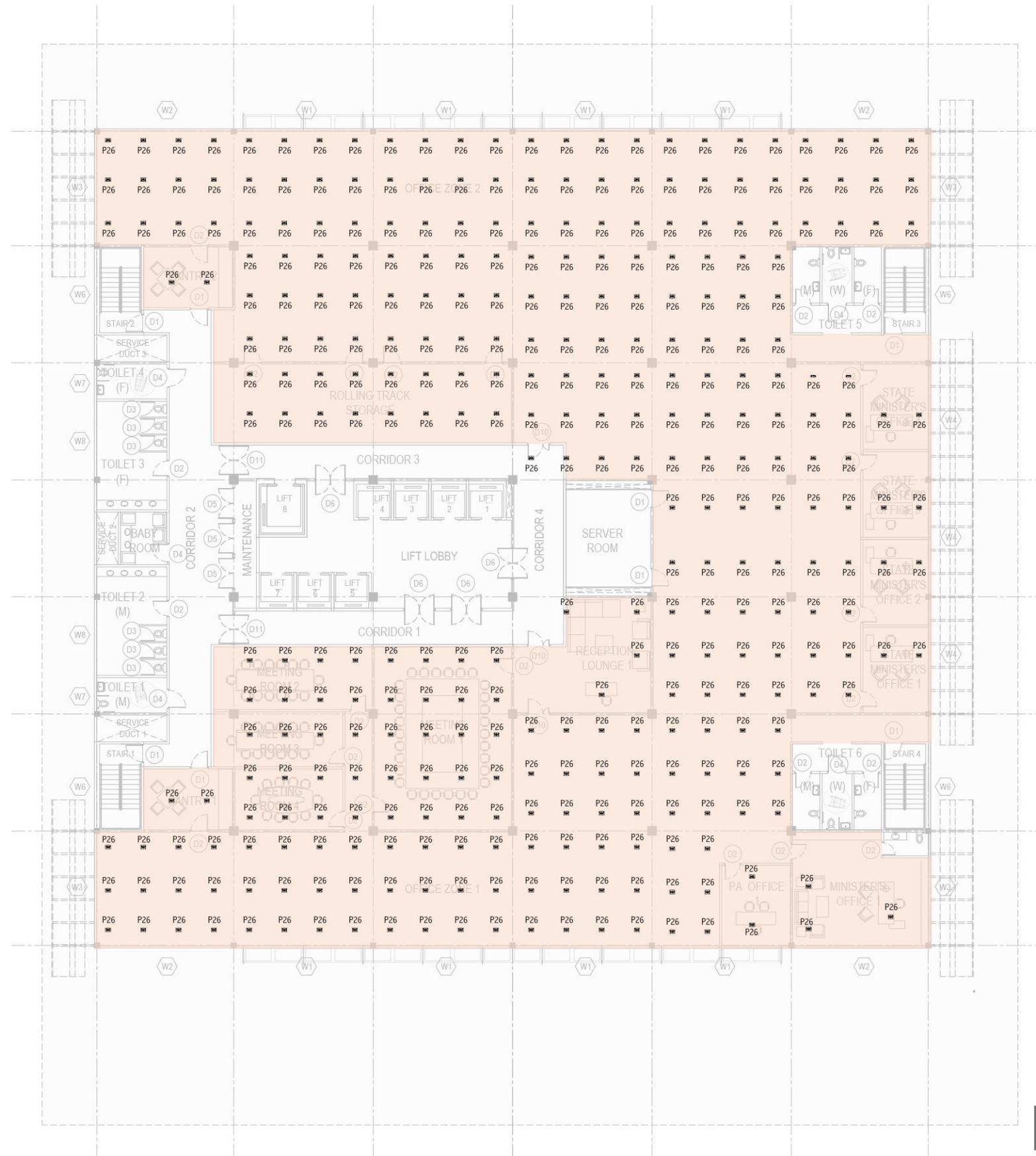
LEGEND

SYMBOL	Gedor Ctg Number	DESCRIPTION
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	P28	WALL CONCEALED MULTIMEDIA OUTLET CONSISTING OF 2GANG 13A SOCKET, R111 AND R145 FEMALE CONNECTORS

POWER LAYOUT SECOND AND THIRD FLOOR PLAN

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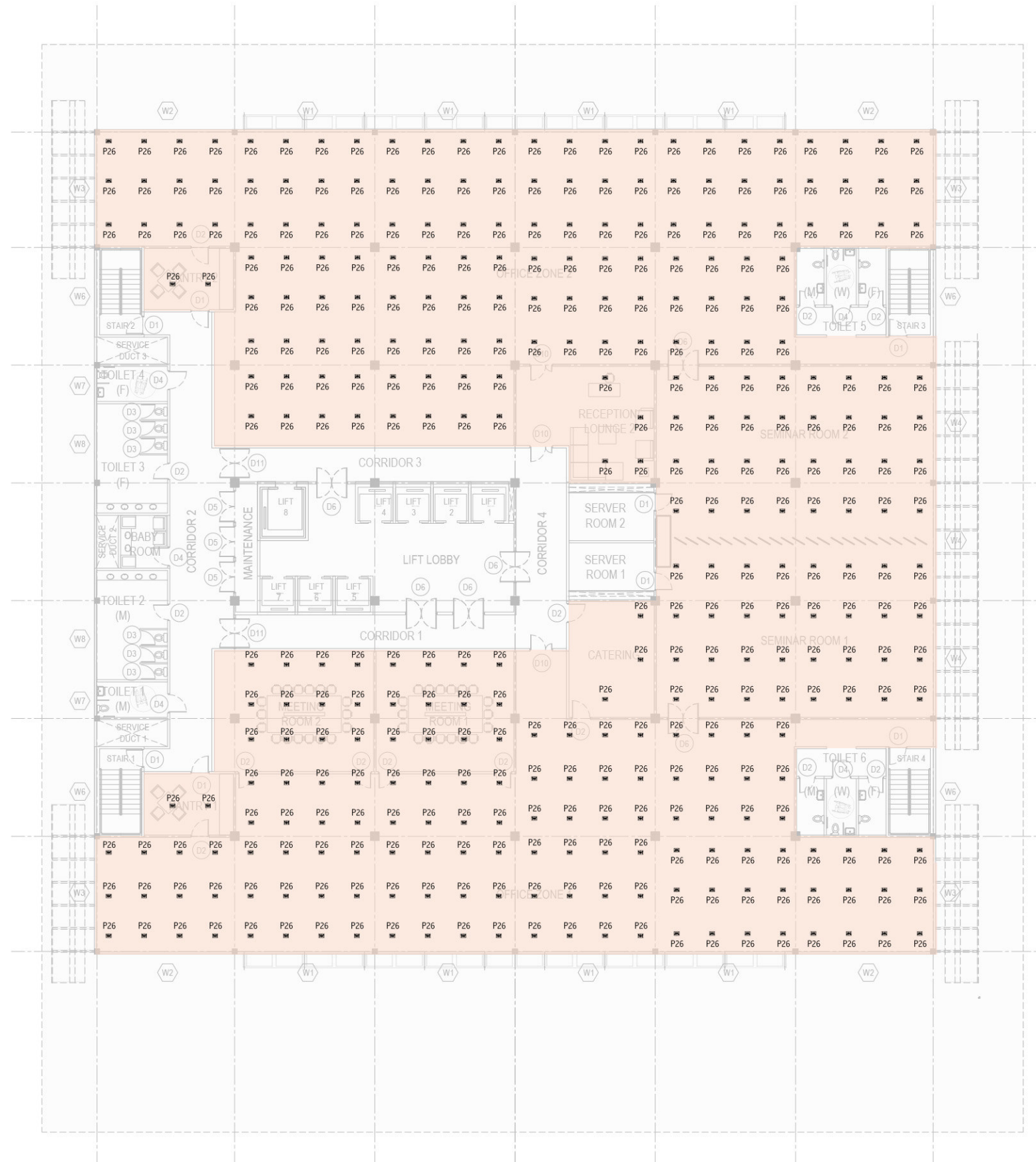


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	P28	WALL CONCEALED MULTIMEDIA OUTLET CONSISTING OF 2GANG 13A SOCKET, R111 AND R145 FEMALE CONNECTORS

POWER LAYOUT FOURTH FLOOR PLAN

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POWER LAYOUT FIFTH FLOOR PLAN

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