GIFT Area

Intelligent Building Management System (IBMS) Guidelines for Building, Campus

GUJARAT INTERNATIONAL FINANCE TEC-CITY

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1 INTRODUCTION

1.1 BACKGROUND

Government of Gujarat vide its G.R. No. UDA/10-2007/2180/V dated 15/05/2007 has accorded approval to the development of Gujarat International Finance Tec-City (GIFT) Area and approved formation of Gujarat International Finance-Tec City Company Limited (GIFTCL) as a Joint Venture Company for the implementation of the Gujarat International Finance Tec-city project.

In pursuance of the provisions contained in clause (m) of sub-section (2) of section 12 and clause(c) of subsection (2) of section 13 of the Gujarat Town Planning and Urban Development, 1976, the Competent Authority vide its G.R. No. GH/V/170 of 2011/GIFT-102011-2523-L dated 19.10.2011 has notified the GIFT Area Development Control Regulations (GIFT DCR). These Regulations shall form basis for the design guidelines to be formulated for specific areas and from time to time which will guide the micro-level development.

The Intelligent Building Management System (IBMS) Guidelines are prepared and recommended by the Competent Authority.

These Guidelines shall be applicable for the developments as per the GDCR. GIFTCL may amend these guidelines from time to time.

1.2 VISION

The vision of GIFT project is – "To develop a global financial hub for international and domestic financial services which will serve as a paradigm for Next Class Development in terms of Quality of Life, Infrastructure and Ambience, utilizing Land as a precious resource." Consistent with the vision for development of GIFT, the vision for GIFT IBMS is -

"To serve towards developing a safe, secure, smart and sustainable habitat for business and living."

GIFT's meaning of 'smart building'… A smart building is the integration of building, technology, and energy systems. These systems may include building automation, life safety, telecommunications, user systems and facility management systems. Smart buildings recognize and reflect the technological advancements and convergence of building systems, the common elements of the systems and the additional functionality that integrated systems provide. Smart buildings provide actionable information about a building or space within a building to allow the building owner or occupant to manage the building or space.

Smart buildings provide the most cost-effective approach to the design and the deployment of building technology systems.

Smart buildings integrate building technology systems at a physical, logical and application level. The foundations of a smart building are structured cable, open network protocols and standardized databases. For building developers and owners, smart buildings increase the value of a building. For property and facility managers, smart buildings provide more effective subsystems and more efficient management options, such as the consolidation of system management. For building architects, engineers, and construction contractors, it means combining portions of the design and construction, with resulting savings in project management and commissioning time.

The latest trend that is dramatically impacting IBMS industry is that of controlling and monitoring building automation controls over IP networks. This trend has accelerated in the recent years with the availability and proliferation of IP-based control systems and adoption of Cloud, web services over IP networks.

"IP-based building automation systems are gaining momentum, thanks to the various contributing factors ranging from internet penetration to cheaper computing devices and platforms. Information technology is a powerful tool, and enterprises could effectively exploit the existing infrastructure to integrate building systems into them, enabling remote access, management, and distributed control.

Technologists designed the next generation IP technology, called IPv6, in such a way that there is an IP address available for virtually every grain of sand on earth. Obviously, the number of devices, applications and services based on IP technologies are growing exponentially, and it is imperative to have sufficient IP addresses to cater to the same."

Pertaining to the application type and requirements, developers and enterprises can make use of the flexibility of IP technologies to realize interoperability and convergence. The network must be customized to provide a perfect balance between the capital and the security of the network. In most of cases the users contribute to security problems, and hence their knowledge and perspective of network security must be enhanced for the benefit of the building.

1.3 AIM AND OBJECTIVES

GIFT IBMS aim is:

"Building shall identify the defects and inform / alert user prior to user noticing the problem so that the defect can be fixed before causing total failure and inconvenience."

In order to achieve aforesaid aim, following **objectives** are ascertained:

1. Integration of building, technology, and energy systems
2. Energy Management and optimization of costs
3. Enhancing facilities operating efficiency
4. Real time performance of the building
5. Ensuring occupant safety, security, and comfort
6. Maintaining and upgrading quality of built environment
7. Efficient disaster management
8. Realizing to a great extent Carbon Neutral building/facility
9. Parking management system

2 GIFT IBMS

2.1 GIFT IBMS PLAN

GIFT intends to gather data/information of building, campus[1] (up to individual office / floor / flat (residence) / Individual end User level) at a single Control Command Center from where necessary commands will be further distributed. This will require proper management of facilities starting from micro units inside buildings up to macro management at city level. In order to achieve this following hierarchy of management is proposed:

- **C1** – Unit Control Command Center: Individual offices / flat (residence) / Individual End User
- **U1** – Unit Control Command Center for Utility building individual office / individual sub-block / individual end user.
- **C2** – Building Control Center: Entire building including common areas, utility areas, building open areas, refugee floors, parking areas.
- **U2** – Utility Services Control Command Center: GIFT's utility corporate service organization (like DCS, Power, Water …)
- **C4** – City Control Command Center

C1s and U1s are the control command centers which will cater to various end users. Further this information will be transferred to Building Control Center (C2 and U2). All the information pertaining to entire building of C2s, and Utility Service Control Command Centers (U2s) will be accessible from City Control Command Center (C4). In case of unforeseen events City Control Command Center (C4) shall be in a position to take control of the entire building remotely. Also, City Control Command Center (C4) with all information collected from the building shall carry out relevant system analysis and take necessary action in case of out of limit operation is encountered.

GIFT IBMS will be implemented as an integrated, open solution, which will enable GIFT's City Control Command Center (C4) connectivity through standard Cloud / Web interface.

Following are important layers of GIFT IBMS plan which together give way to an efficient 'Safe & Smart' building operation:

1. Equipment's, instruments with minimum technical requirements and performance standards specific to the monitoring zones and various sub-systems of IBMS.
2. Campus refers to developments such as school, hotel, hospital, exhibition center, MLP.
3. Interconnection between various IBMS components for data aggregation, database management to provide desired analytics, outputs.

4. Monitoring Zones - Area, premises, facilities, equipment's, other physical elements etc. that need to be monitored e.g., Building Core, Units / Premises, Corridors, Open Areas etc.

5. Integration of Monitoring Zones and building level command center (C2) and GIFT's City Command Centre (C4) for intelligence, user Interface, visualization and enhanced decision making.

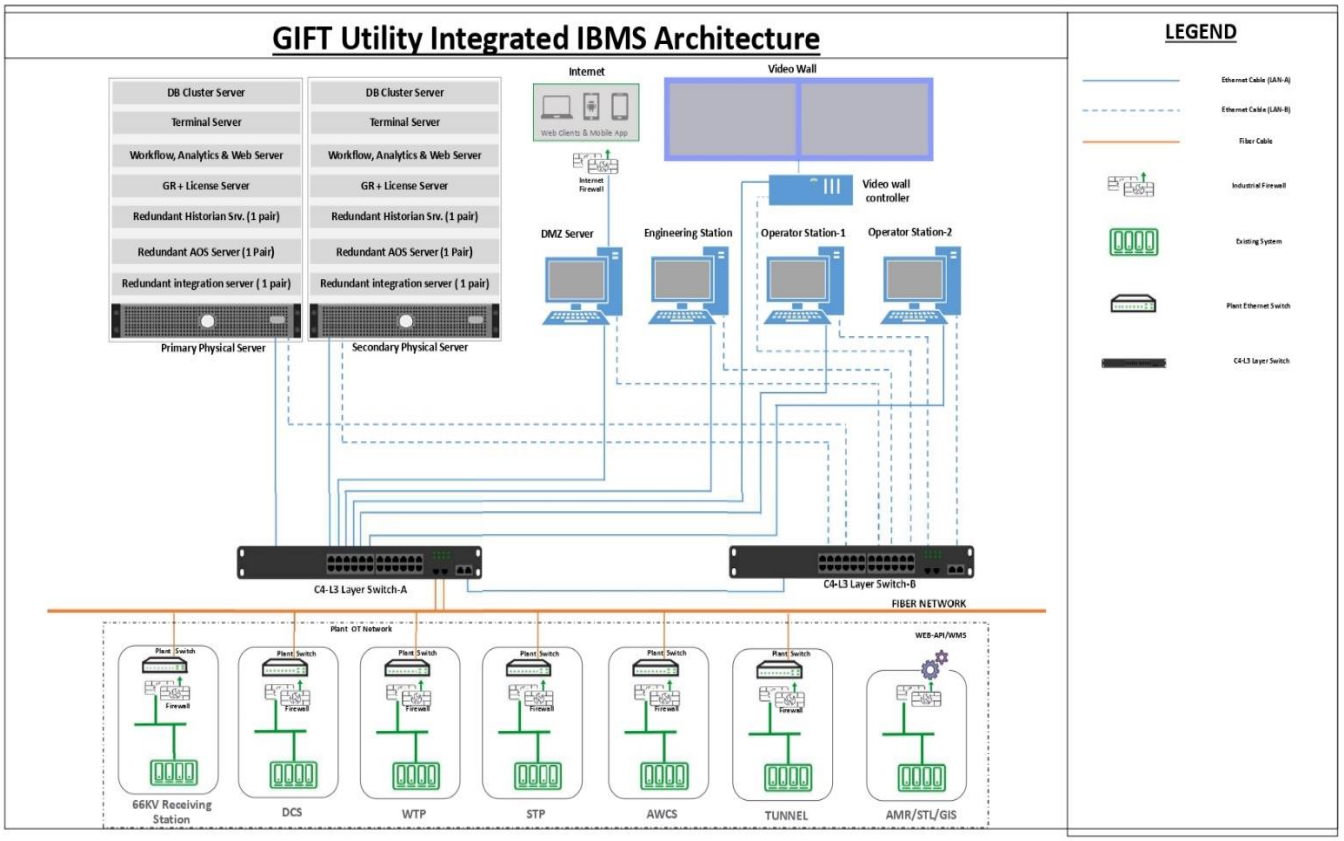
2.2 GIFT IBMS TOPOLOGY

Figure below depicts the IBMS topology in terms of interconnectivity between building, blocks, and regions. There will be a city level fiber optic backbone from which all blocks and C4 will extract branch connections. Each building in a block will tap off connections from block's fiber optic. Orange color fiber network, showing cable network starting from linking point with Telco Service provider up to the building level will be provided by GIFT. Green color fiber network represents building internal networking inclusive of the end users which will be laid by the developer therefore completing the network from C4 up to C1 level.

The building will have a dedicated control command center room that will have the standard environmental, security and power and cooling facilities. It will be operated by respective developers / professional agencies. In view of catering to entire GIFT area zonal telecommunication (Meet Me Rooms (MMR)) rooms are specified. These will house Telco service equipment's to support ICT network of the entire GIFT area.

The system shall be completely modular in structure and freely expandable at any stage. The system shall be fully consistent with the latest industry standards. To enable efficient functional system integration and to provide maximum flexibility and to respond to changes in the building use, the system offered shall support the use of BACnet, Lon Works, Modbus, M-bus, Ethernet TCP/IP and Internet communication technologies.

Gujarat International Finance Tec-City (GIFT)



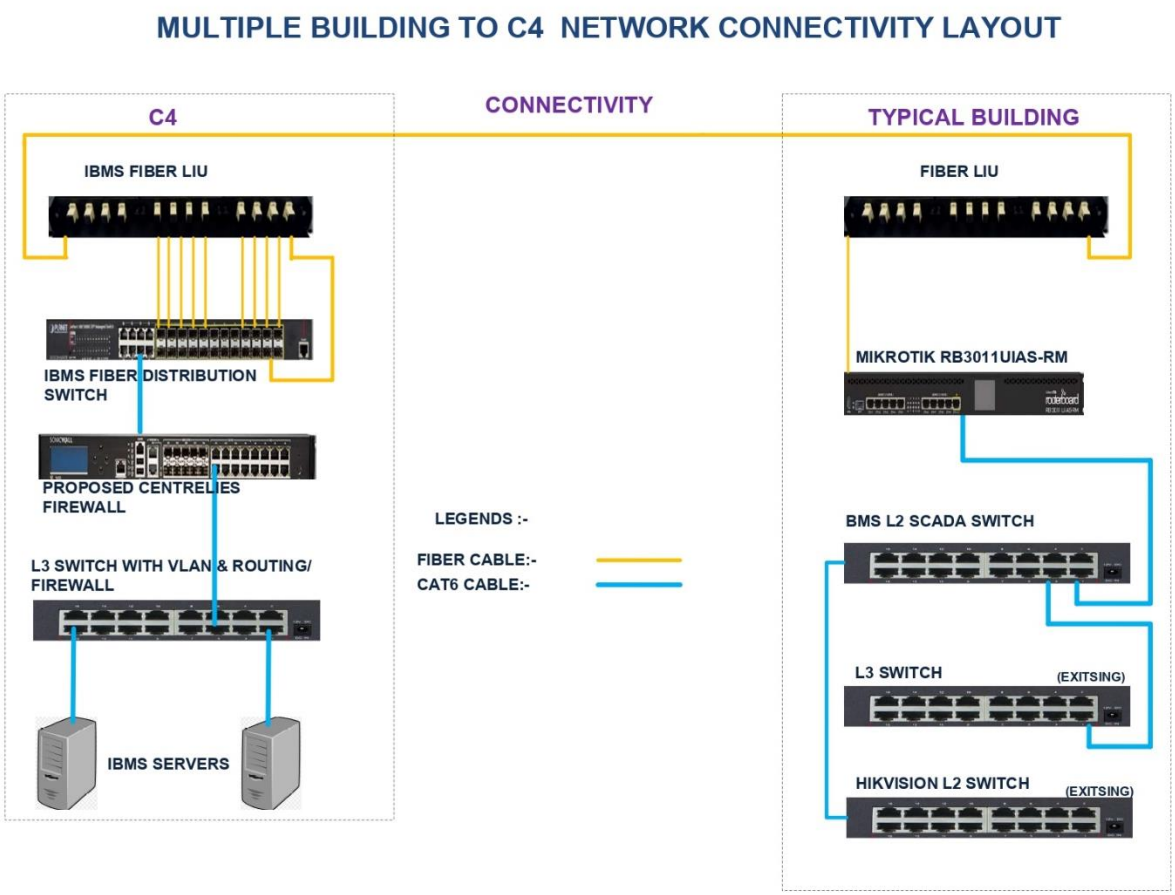


Figure1: GIFT IBMS topology

2.3 SALIENT FEATURES OF GIFT IBMS

A key feature of the GIFT's IBMS is its scalability and its ability to grow as the city develops. The system shall be completely modular in structure and freely expandable at any stage. This will also provide flexibility to cater to new and evolving in-building services, track, and address tenant needs, and be vendor independent. Moreover, it will use the City's standard ICT network infrastructure to provide attractive, efficient, and manageable services to help deliver the GIFT Vision. Following is the list of salient features of GIFT IBMS:

- Sustainability
- Scalability
- Applicability
- Advance Technology and communication and Interface
- Integration
- Intelligence
- Interoperability
- Automated event management

2.4 GIFT IBMS SUB-SYSTEMS

Considering the GIFT IBMS vision, objectives, and plan, IBMS sub-systems shall initially comprise of the following:

Building Management System (BMS)

- HVAC
- A. Commercial and Recreational:
- 1. End-user AC equipment operational data, Thermal Energy Consumption data is recommended up to C2 & U2.
- 2. End user (C2 & U2) data not required in C4.
- 3. All required data has already structured in DCS SCADA.
- B. Residential:
- Thermal Energy Consumption data of each CEM (Consumer Energy Meter) shall be shared to DCS SCADA as per Residential metering policy
- Lighting Control
- Water Monitoring
- Billing (Energy, Water, Gas etc.) – DCS Billing shall be as per Existing scheme through DCS System.
- Solar photo voltaic system
- Facility Management system interface
- Facility Management alerts / emergency messaging

Life Safety

- Fire Detection and Alarm System (FDAS) – data shared to C4 via C2
- Evacuation and Public Address System (EPAS) – data shared up to C2
- Notification Signage System – data shared up to C2
- Assembly areas management system – data shared up to C2

Security

- Security Surveillance System (SSS)
- Access Control System (ACS)
- Parking management system
- Perimeter monitoring and protection system

All above systems shall have interoperable features with database transparency between systems thus ensuring complete integration between systems, flexibility in programming, logical operations implementation, simultaneous decision on various systems based on a given critical event, GUI migration through data from one system to another for bringing event clarity.

The requirements related to Engineering Utilities is mentioned in respective READY RECKONERS, developers should comply the same.

Following are the mandatory requirements for communication network desired for efficient interaction amongst all sub-systems of IBMS in GIFT Area:

- Nature – It is mandatory or minimum requirement to have networked; Point to Point; Peer to Peer; Process; Human Machine Interface; Graphical user interface as basic feature of the proposed IBMS.
- Interfacing and integration with all utilities, services, and GIFT's C4.-
- Communications system shall be adequately sized for trouble free transmission, bandwidth capacity, location, cabling, wireless etc.
- Communications protocol of well recognized industry standards like BACnet, LON, Modbus, TCP/IP shall be supported.
- Local and remote access should be possible.
- The communication network among various systems should be enabled through an open platform which will enable:
    - Integration of multiple sub-systems
    - Services to be delivered in a seamless manner
    - New services to be added easily
    - Analytics information for Management decision
    - Shall be common platform for various types of development
    - Wide protocol drivers support
    - Large database handling capability
- All the metering devices and installation shall be as per relevant utility authority recommendation

2.5 GIFT "SAFE AND SMART BUILDING" ARCHITECTURE

The "Safe & Smart building" architecture for GIFT is designed to support monitoring, management, and control of all property assets within GIFT Area. Proposed scheme of IBMS architecture shall consist of four levels (as show in figure below):

i. Service Level (Infra level)
ii. Management Level (Building level)
iii. Control Level
iv. Field Level

Installation and maintenance of IBMS component within the building will fall in purview of the occupant except for in common areas, passages where developer will provide the needful. For unhindered operation of IBMS it is necessary that all IBMS components and

equipment's are designed, installed, and operated as per applicable national / international subject specific codes / guidelines. Each level of the system.

shall share control and information with next level system but should also be capable of operating independently. For example, Control Level shall be capable of operating independently without support from Management Level or in the event of any failure of management level.

As shown in the figure below, field level, control level and management level infrastructure provision and maintenance falls in developer's and user's scope. Transfer of information and component installation outside building will be developed and maintained by GIFT.

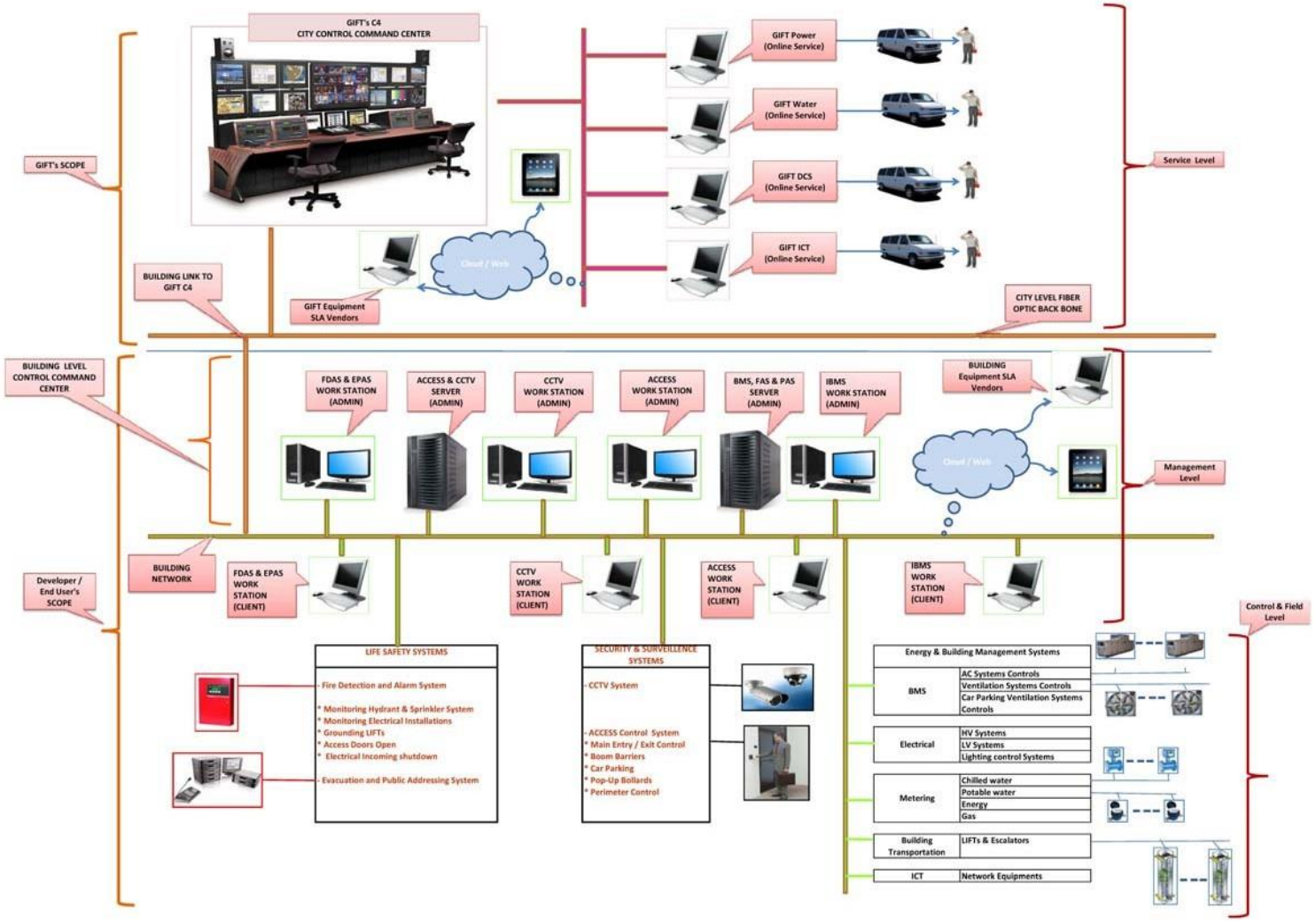


Figure 2: GIFT IBMS System Architecture

2.5.1 Service Level

Service Level shall allow various systems in each building to be connected through a common platform to GIFT C4. One or more third party Service Centers will perform centralized remote monitoring, alarming and fault detection in building management, life safety and security systems etc. GIFT's city control command center C4 shall be capable of accessing remotely the systems through a standard interface platform. Service level interface shall address the following:

- Emergency notification
- Failure of end user incoming services
- Failure of building core services
- HVAC - Building consumption details
- Parking area functional / operational details
- End user consumption details
- Any breach in Security or Security violation
- Any services equipment failure
- GIS interface
- Structural failure notification (rust level, crack etc.)
- Failure in infrastructure services (Ex. DCS, water supply, sewage, drainage, electric distribution etc.)

2.5.2 Management Level

Management Level shall provide a uniform view to all systems through the open Enterprise operating system platform. All the systems - controls of cooling, ventilation and lighting, consumption measurements, access controls, intruder alarms, fire alarms and CCTV NVR HD systems - shall be integrated with the Enterprise operating system using device drivers, gateways. The Enterprise operating system shall offer at least the following common services to be used by all connected systems:

- Alarms
- Historical trending
- Logs and reporting
- Function profile
- Equipment profile
- User profile
- Role management
- Operation Regulation
- Maintenance Regulation

Management Layer shall not be responsible for any controls except for the global decision inputs. The critical control functionality is taken care of by the intelligence on the Control Layer.

The Enterprise Operating System (EOS) shall enable efficient management of user rights. The EOS shall be capable of forwarding alarms to mobile phones using SMS, local alarm printers, GIFT's city command center or to Service center. It shall be possible to browse the alarm history for reporting and statistical purposes.

The network technology shall be based on the IT standards, such as TCP/IP, and be compatible with latest LAN, WAN, Web, Cloud technology.

Also, it is essential to provide redundancy at this layer to safeguard prime database which include billing information. System engineering of this layer shall consider database retention for a minimum period of one year and six months. Further to it database shall be backed up using advance backup storage mechanism.

2.5.3 Control Level

The Control Level shall consist of a distributed network of smart controllers, which communicate to each other using a commonly known field bus like {BACnet (Building Automation Control Network), LON, Modbus, and M-Bus} over IP. Connectivity towards Management Level and beyond (C4) shall utilize standard TCP/IP protocol.

The controllers shall include all the intelligence of the system. All communication shall be event based real-time peer-to-peer communication. All controllers shall be capable of operating autonomously independently of Management Layer. For example, all systems react to alarms on the Control Layer without interference from upper layers.

The area controllers, zone controllers, and building controllers all shall utilize the BACnet over IP protocol. BACnet is an ISO world-wide Standard protocol designed to maximize interoperability across many products, systems, and vendors in buildings. All the products used in control Level shall have international product certifications like UL, CE, EN, BTL etc. and shall have a life span of minimum ten years.

2.5.4 Field Level

The Field Level shall consist of industry standard sensors and actuators, smoke detectors, card readers and IP cameras...etc. These products shall have international product certifications like UL, CE, EN, BTL …etc. Also, the products proposed shall be of latest version with service support available for minimum of ten years. Care shall be taken in providing metering devices which shall be as per relevant utility authority recommendation.

2.5.5 Important Characteristics of GIFT IBMS architecture

- All the in-building services (including fire / life safety, security, access / video, elevators, lighting, energy management, 24 x 7 monitoring, HVAC and communications) will converge onto a single in-building ICT network using common network protocols (TCP/IP) and standard interfaces. Data from individual sensors, alarms, devices, services, and tenants will be protected using secure virtual local area network (VLAN) mechanisms and management.

- The sensor and service data from each "safe and smart building" will be brought back to a central monitor and control center (C4) via the across-City ICT. A single front-end application will be used to integrate each of these services into a common monitoring, control, and management system.

- This system will also have the ability to undertake "cause-and-effect" analysis and automatically advise facilities management personal of key alarm situations and knock-on impacts of specific system failures, alerts or operating conditions. This means that in addition to linking multiple "safe and smart buildings" in GIFT back to the central monitor and control center, the cross-City ICT will be used to provide an external interface to emergency and third-party service providers. These connections will be critical for the timely intervention of security and life safety services such as the fire department, police, and ambulance services. Key alarm and alert services will therefore be identified and directly routed to these agencies in parallel with informing the central monitor and control center. The architecture will also support this method of working for other third-party service providers who provide critical operational systems or services to individual properties, for example HVAC, energy, and similar services.

- Key events and information will be displayed on Graphical User Interfaces (GUI) within the control center and operators will have the ability to look into the detail of individual events and "safe and smart building" components where this information is needed to investigate, respond to or clear a flagged problem.

- The support structure for GIFT will include mobile facilities management staff that has the local knowledge of individual properties to provide the hands-on resolution of building related issues, problems, or service requests.

- The developer shall be responsible for efficient operation and functioning of above systems and also for regular upkeep and necessary upgradation of the systems starting from the day of commissioning and for entire life span of the building.

2.6 GIFT IBMS INFRASTRUCTURE

2.6.1 Physical Infrastructure

The IBMS sub-systems comprising of installation and networking of physical infrastructure such as various instruments, devices, facility etc. for effective integration as per the GIFT IBMS System Architecture (Field, Control, Management Service levels) shall be carried out by the developer at building level C1, block level C2 and by GIFT at utility building / module level (U1), block level (U2) and City Control and Command Center C4.

At the GIFT city level, the infrastructure for parking guidance and management such as information displays, screens, variable message signs etc. shall be provided at various identified location by GIFT to enable displaying / providing the information pertaining to respective MLP. The displayed information will be sourced from the Block level / C4.

The physical infrastructure at the office premises will be provided and managed by the respective User / Developer while at the building level will be provided and managed by the Developer and at the GIFT area level provided and managed by GIFTCL through provision of Central Command and Control Centre – zonal TELCO facility for effective integration with GIFT ICT infrastructure.

The following table below explains the functional location of various IBMS sub systems at individual office / module level (C1, U1) and Building level (C2, U2).

Table 1: Functional Locations of IBMS Sub-system controls

	IBMS Sub System	C1, U1 Functional Locations	C2, U2 Functional Location
a	Building Management System (BMS) - Personal Computer / Server	Part of Facility Manager office / cabin	Part of Building Facility Manager office / cabin; Dedicated space with A/c, controlled access, furniture
b	Fire detection and Alarm system Control Panel (FACP)	FACP - Office reception	FACP Part of Building Facility Manager office / cabin
			Online repeater in Security Officer office / cabin
			Online repeater in Building Ground floor Lobby reception
			Online repeater in Refugee floor(s)
c	Fire detection and Alarm system (GUI Station - Computer / Server)	GUI Station Part of BMS (personal computer / Server) - Part of Facility Manager office / cabin-	FAS GUI Station (personal computer / Server) - Part of Building Facility Manager office / Cabin; Dedicated space with A/c, controlled access
d	EPA network controller and GUI station - Computer / Server	GUI Station Part of BMS (personal computer / Server) - Part of Facility Manager office / cabin	- do -; call console in Security officer office / cabin + reception lobby + refugee floor(s)
e	CCTV GUI Station (computer / Server	Part of Facility Manager office / cabin OR Reception	- do -; Client station in Security officer office / cabin + reception lobby
f	CCTV head end equipment's (NVR / computer / Server)	Part of Facility Manager office / cabin	Part of Building Facility Manager office / cabin; Dedicated space with A/c, controlled access
g	ACS GUI Station (computer / Server)	Part of Facility Manager office / cabin OR HR Manager office / cabin	ACS GUI Station (personal computer / Server) - Part of Building Facility Manager office / cabin; Dedicated space with A/c, controlled access; visitor management system in reception lobby
h	Parking GUI Station (computer / Server)	Part of Facility Manager office / cabin OR HR Manager office / cabin; Toll Clients workstation in the parking area	Parking GUI Station (personal computer / Server) - Part of Building Facility Manager office / cabin; Dedicated space with A/c, controlled access; Toll Clients workstation in the parking area

Table 2: Functional Location of Home Automation System

	Home Automation Server	HAN Functional Location	C2 Functional Location
a	Individual Flat (Residence)- Personal Computer / HAN Server	Part of Individual Flat (Residence)	Part of Apartment (Building) Manager office / cabin; Dedicated space with A/c, controlled access, furniture

The system shall be completely modular in structure and freely expandable at any stage. The system shall be fully consistent with the latest industry standards. To enable efficient functional system integration and to provide maximum flexibility and to respond to changes in the building use, the system offered shall support the use of {BACnet, Lon Works, Modbus, M-bus} over IP, Ethernet TCP/IP and Internet communication technologies.

Building plans and respective floor plans shall reflect IBMS infrastructure components as also defined in UDAS guidelines.

Media Deployment

Initial deployment of sufficient fiber within the GIFT area will support all current services/applications as well as future demands without incurring costs of fiber up gradation.

2.6.2 Virtual/Soft Infrastructure

Choice of IP and Ethernet

GIFT will use IP and Ethernet solutions for network of GIFT area which will ensure that the protocols are future proof (suitable for the foreseeable future). In addition to this the network and hardware are to be designed to support IPv6 as and when it is required.

IP and Ethernet protocol

Entire GIFT area's design is based on IP, which is the core protocol of the internet, and all applications will be supported by the same. In addition to this the network and hardware are to be designed to support latest IP version as and when required.

GIFT will use Ethernet as the transport protocol that runs over the physical medium such as CAT6 cable or fiber, and it carries IP.

Cloud Technology

In GIFT all IBMS systems shall have adequate provision for their connectivity to the GIFT's cloud / web portal.

Bandwidth

GIFT will use high bandwidth to guarantee speedy information access and pleasant work experience. The deployment of sufficient fiber during the construction phase ensures that all high bandwidth applications can be supported.

QoS protocol

In order to avoid delays in transmission of prioritized information GIFT will use QoS protocol. This design is flexible enough to allow mapping of traffic to different classes of service ensuring appropriate levels of bandwidth and latency for different types of traffic considering future requirements of high bandwidth.

BACnet

BACnet (Building Automation Control Network) over IP is an ISO world-wide standard protocol designed to maximize interoperability across many products, systems, and vendors in commercial buildings. Life safety, security and building management Systems shall be provided with complete bi-directional communication with monitoring and control of the following systems:

BMS

- Building automation systems, such as DDC, heating / ventilation / air-conditioning (HVAC), elevators, escalators, light and energy management
- IP network and device surveillance (e.g., switches, routers)

Life Safety

- Fire detection and alarm systems
- Public address and voice alarm systems (PA/VA) for evacuation and audio information
- Emergency exit/escape route management
- Intercom systems
- Two-way communication system

Security

- Video systems, such as NVR, storage devices and IP cameras
- Access control systems, visitor management systems, guard tour systems
- Intrusion detection systems
- Perimeter fence control
- Mobile devices for security guards
- People and asset tracking system
- Parking guidance and management system

Table 3: IBMS Infrastructure for control units

Control Units									C2						
Network provisions for IBMS		IT Network	Media	Passage	Power Req.	Protocol	Bandwidth	External link	IT Network	Media	Passage	Power Req.	Protocol	Band width	External link
a	Building Management System (BMS) - Personal Computer / Server	Part of Office / End User Area	Cu - CAT 6 Cable	ELV Shaft / Dedicated cable trays / Raceways	Emergency Power required	IP / Ethernet / BACnet	100Mbps / 1Gbps	C2 IP Back bone (IBMS N/W)	Part of Building network	Cu - CAT 6 Cable/ OFC	ELV Shaft / Dedicated cable trays / Raceways	Emergency Power required	IP / Ethernet / BACnet	100 Mbps	C4 IP Back Bone (IBMS N/W)
b	BMS controllers / gateways													- do -	
c	Fire detection and Alarm system (FACP)													- do -	
d	Fire detection and Alarm system (GUI Station - Computer / Server)													- do -	
e	EPA network controller and GUI station													1 Gbps	
f	EPA Amplifiers													- do -	
g	CCTV GUI Station (computer / Server)													- do -	
h	Cameras - IP													- do -	
i	ACS GUI Station (computer / Server)													- do -	
j	ACS Controller - IP													100 Mbps	
k	Parking GUI Station (computer / Server/Toll Client)														
l	Parking Controller - IP														
m	Home Automation Network	Part of Flat (Residence)													

2.7 INFORMATION EXCHANGE AT GIFT

In the following figure the flow of information from each end user, building, and utility services to GIFT's C4 is categorized into:

a. Actionable information
b. Advisory information
c. Notification information for example:

1. Emergency alarm from a building / floor / area is routed to GIFT's emergency services operation through GIFT C4. GIFT will advise or take appropriate action to resolve the emergency situation aroused at that location.

2. Suitable infrastructure to be provided to deliver the necessary information to GIFT Fire station control room.

3. Public address system within block can be used to assist users to locate vehicle, unaccompanied person.

4. Prelisted vehicle notification to the registered user.

5. Parking occupancy / availability through information system at the city level to destine the user.

6. Overall parking situation (no. of vehicles, locations, utilization etc.) monitored at City level in C4.

7. Regular shuttle service announcements in common areas.

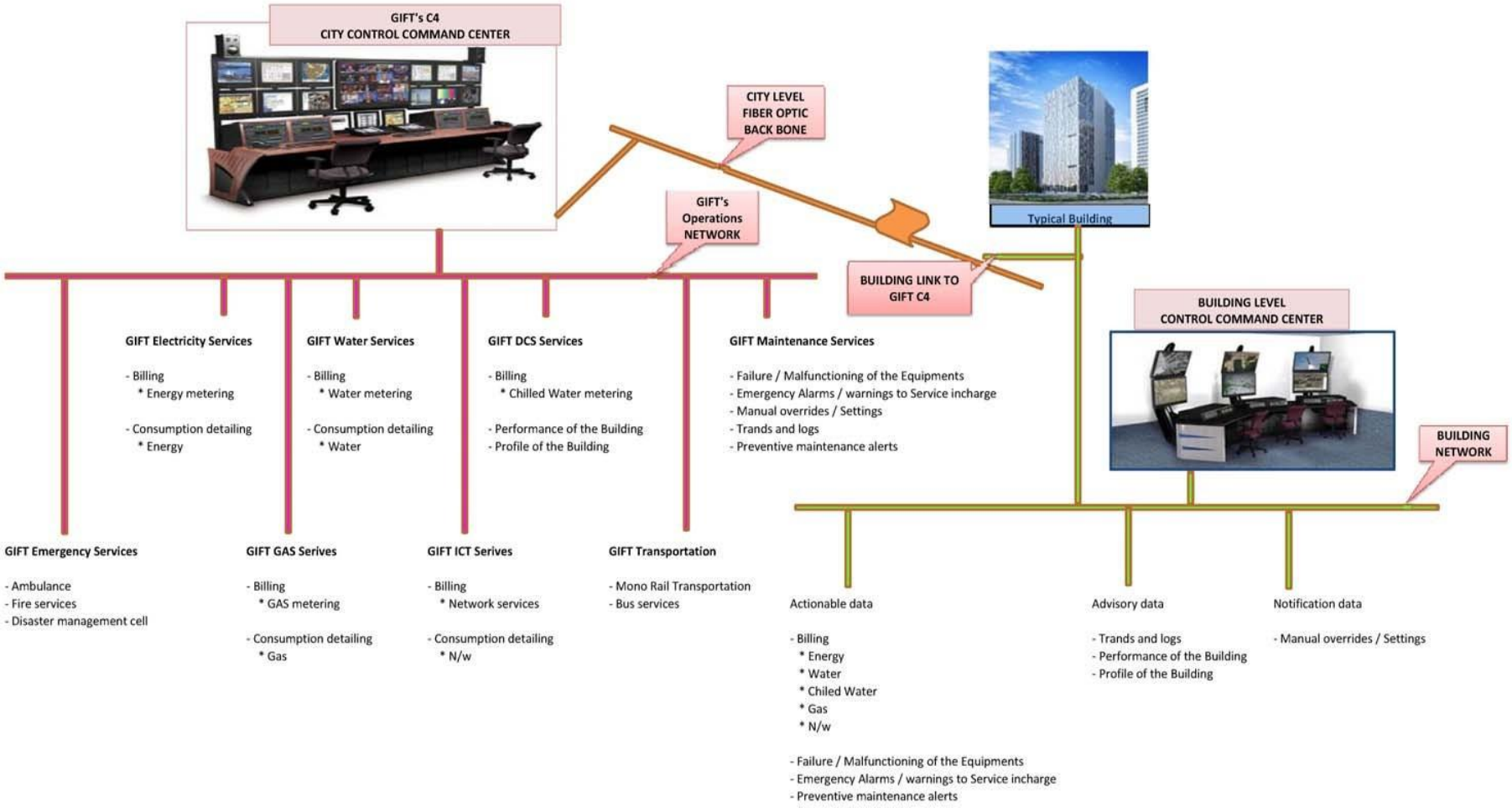


Figure 3: Information Exchange between Buildings, GIFT's C4 and subsidiaries

2.8 INTERFACE LEVELS OF GIFT IBMS

The nature of Interface shall be as follows:

Developer - GIFT Interface:

- Alarm monitoring and alarm handling by multiple operators
  - Fire alarms
  - Intruder alarms
  - Security breach alarms

- Remote diagnostics, energy optimization and trending
  - Consumption reports for energy management and billing – Information only

- Parking management information for infra guidance system

User - Developer Interface:

- Advising / notifying the mode settings of the controlled devices / equipment
- Camera views (on demand / need basis)
- Alarm list browsing
- Parking booking, group analytics information

Regular audit mechanism for the developers or GIFT's incoming services and life safety systems shall be in place.

GIFT IBMS shall primarily interact at these levels:

Table 4: GIFT IBMS Interface

Level	Location	IBMS	Interface
Occupant Level	User - Premises	IBMS requirements would be specified for users / premises to Users through Developer by GIFT	**User Interface** between the Occupant C1, U1 / Building Trunk level C2, U2. User shall be transparent in providing minimum interfaces which are relevant to life safety, security, and GIFT's incoming services
Trunk Level	Developer - Building	IBMS requirements would be specified at Building Level to Developer by GIFT	**Developer Interface** between the Occupant C1, U1 / Building Trunk C2, U2 / C4 level. System provided by the developer shall be flexible enough to accept various brands and technologies which would come up from Users. It is the responsibility of the developer to ensure that the user's system is compatible with his system.
GIFT Area Level	GIFT - Central Command Control Centre (C4)	IBMS specified for GIFT interfacing various buildings / premises and sub / central command control center	**GIFT Interface** between the Buildings C2, U2 / C4 level. It is the responsibility of the developer to ensure his system is compatible for interfacing with GIFT's C4. Developer shall plan and provide adequate database support to hold transactions between his system and GIFT's C4. Developer shall consider redundant provision wherever applicable and called for by GIFT.

3 BUILDING MANAGEMENT SYSTEM

3.1 INTRODUCTION

The Building Management System shall comprise of the following sub-systems:

- HVAC and utility services monitoring control
- Lighting System
- Energy Management (Electrical Metering and Load Planning)
- Water Management (Water metering and consumption planning)
- Horizontal/Vertical Transportation System
- Life safety systems integration
- Assembly area management system
- Notification signage system
- Security and surveillance systems integration
- Weather monitoring
- Solar Photo Voltaic system
- Seismic impact monitoring
- Facility management system

The following mechanical, electrical and PHE equipment / services located at different locations shall be monitored, controlled, analyzed, and guided by BMS: (Suggestive - **At the discretion of the developer)**

Mechanical / HVAC -

1. Chilled Water Secondary Pump sets
2. Fresh Air Handling Units
3. Air Handling Units
4. Ceiling suspended Units
5. Fan Coil Units
6. Variable air volume systems
7. Induction variable air volume systems
8. Thermal diffuser system
9. Chilled ceiling system
10. Fresh, Exhaust air and Ventilation Fans
11. Staircase Pressurization Fans
12. Lift well Pressurization Fans
13. Car Parking Ventilation
14. Energy recovery systems
15. Indoor air quality improvement systems

Electrical

1. Mains Incoming
2. Soft integration of ACBs, MCCBs
3. UPS
4. Inverter
5. External Lighting
6. PHE

7. Internal Lighting
8. Internal Public area Lighting
9. Status of Fire Alarm panel
10. Status of Evacuation systems
11. Status of CCTV Prime Equipment
12. Status of Access control system
13. Status of Parking guidance and management system
14. Lifts status monitoring & power consumption
15. Energy metering for incomer and outgoing
16. Alternative energy resource like Solar Photo Voltaic
17. Level monitoring for Water Tank of Fire Protection System
18. Level monitoring for Water Tanks for Domestic Water
19. Level monitoring for Sumps
20. Fire Fighting System Pump sets
21. Water Management Pump sets
22. Water metering

Networking

1. Building incomer status
2. User outgoing status
3. Emergency network status
4. Heartbeat status of redundant systems

Facility Management System

1. Interface with Facility Management System
2. Ensuring regular maintenance alerts
3. Out of range operations notification
4. SLA renewal notification
5. Upgradation alerts on predefined intervals
6. Assembly area management system

3.1.1 **BMS Minimum Requirements (Suggestive -** At the discretion of the developer)

The minimum requirements are as under:

Table 5: Minimum requirement for BMS

Sl. No.	Scope / Equipment	Automation levels for Energy Efficiency and intelligence
1	Layer to support Service Level	**Interface to Service support network:**
		Emergency alarms (Mandatory)
		Equipment failure alarms
		Building consumption log billing log
		Premises incoming consumption billing log
		Building incomings status

Sl. No.	Scope / Equipment	Automation levels for Energy Efficiency and intelligence
		Measurements & verification log (LEED)
		Report to Facility managers
		Report to End Client
		Report Equipment maintenance agency
		Report to Fire services
		Report to Ambulance
		Report to Police
		Report to GIFT Infra services
2	Layer to support Management Level	**Building common & Client areas:**
		Trend & history logs
		Change of state logs
		Incoming consumption analysis
		Outgoing consumption analysis
		Over burden settings report
		Manual overridden settings report
		Savings due to control strategies report
		building performance w.r.t design parameters report
3	Layer to support Control Level	**Controls to incorporate optimized utilization of:**
		chilled water
		Air volume
		electricity
		lighting
		domestic water
		Economizer controls
		Heat recovery controls
		Chilled water & Air balancing controls
		Temperature reset controls
		Sequencing controls
		Demand limiting controls
		Load rolling Controls
		Scheduled operation of the equipment (per Client's requirement)
		Emergency shutdown controls
		Emergency operational controls
4	Layer to support field level	**Monitoring of:**
		Temperature
		RH
		CFM
		IAQ
		kW, Voltage, Current, PF, KVA, KVAR

Sl. No.	Scope / Equipment	Automation levels for Energy Efficiency and intelligence
5	Support third party integration	**Soft integration of:**
		VFDs
		ACBs, MCCBs
		Secondary pump controllers
		Btu Meters
		Energy meters
		Water meters
		Gas meters
		UPS
		Fire alarm control panel
		Evacuation network devices
		Security & surveillance devices
		LIFT management
		Escalators management
		ICT network management
		Parking management system

3.2 BMS ARCHITECTURE GUIDELINES

- BMS shall facilitate monitoring, controlling, analyzing, and guiding of mentioned mechanical and electrical equipment's / services located at different locations from a building specific centralized workstation (Server) with additional operating workstation (Client) for various users. A printer shall be provided along with Server and Client to print alarms, trends, history, and important events. The location of the Centralized workstation (Server), Operating workstation (Client) along with printer shall be located in building control room situated closer to maintenance team (to be agreed with Architect, as per Architectural drawings) and shall be provided with suitable furniture's. The complete information flow to building specific centralized workstation shall be up linked to GIFT's city command center through GIFT's Cloud, Web link. The BMS Software shall be enterprise type capable of handling complete integration of all its sub systems.

- Building Management System design proposed shall have DDC stations with required number of DDC (BACnet over IP) Controllers as per the functional scope defined for each service. The DDC station shall host required number of DDC (BACnet over IP) controllers which shall get information from field sensors for monitoring parameters like temperature, RH, kW, status of equipment's … etc., and controlling the equipment's involved in each service for their optimum utilization and also to measure and verify performance guidelines.

- BMS shall adopt latest TCP/IP, BACnet/IP or LON/IP and web technologies. The BMS shall integrate all sub-systems to the BMS via BACnet/IP or LON/IP or Modbus/IP if

not, a sub-system shall be integrated via a gateway that converts the proprietary protocol to BACnet/IP or LON/IP or Modbus/IP protocol. These sub-systems shall be controlled, monitored, and graphically programmed through the Graphical User Interface (GUI) software of the BMS.

- BMS DDC stations shall be provided for interfacing various field devices to the DDC controller by means of cabling. Power supply to these outstations shall be from Emergency power (backed up by Standby Generators) or UPS (uninterrupted power supply) in coordination with Electrical works. The Outstation serving specific equipment's shall be provided with required volt free contacts, control 0-10-volt signal … etc. The cabling between DDC stations and router shall be CAT6, run on trucking or in conduits. The cabling between routers shall be CAT6 / OFC, run on trucking or in conduits brought to Building Switch (hub) to Building Central workstation and Building Operator workstation.

- DDC controller shall have built-in LCD display unit for local viewing and fault analysis.

- All the components provided for complete functioning of the BMS shall confirm to international certifications like UL, CE, EN, BTL …etc.

- It is vital to envisage complete data volume, traffic expected when entire building is functional with maximum usage and head end equipment's like server, memory, redundancy system, Admin and Client systems shall be sized accordingly with at least 30% spare / excess capacity.

- Submittals from the developer shall consists of all the above said vital information, product data sheets, schematic, and details floor plans.

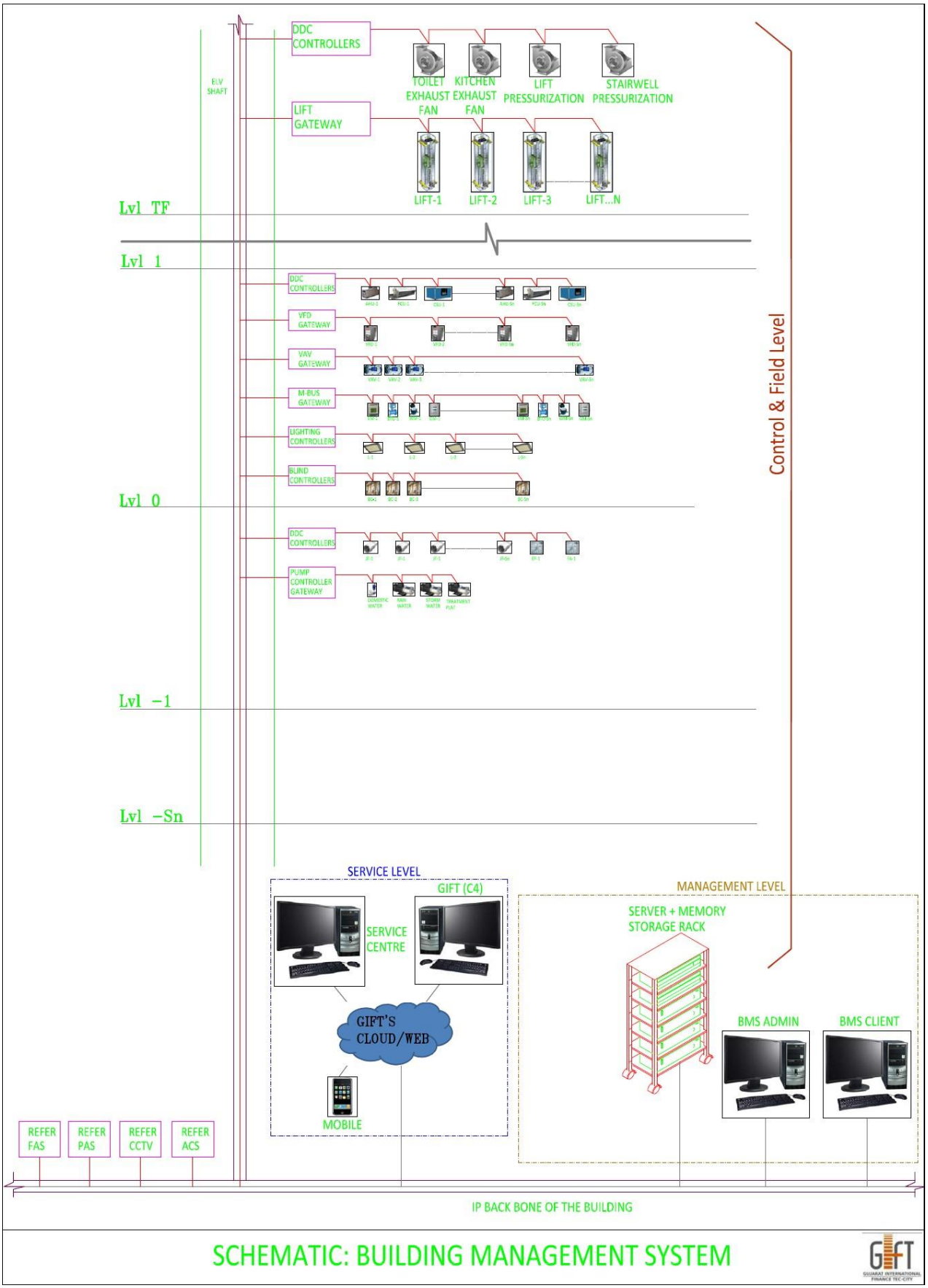


Figure 4: Typical riser schematic of BMS in GIFT building

3.2.1 References

The publications listed below form a part of BMS guidelines:

- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
  i. Standard 135-10 BACNET Building Automation and Control Networks

- Institute of Electrical and Electronic Engineers (IEEE):
  i. 802.3-11 Information Technology-Telecommunications and Information Exchange between Systems-Local and Metropolitan Area Networks-Specific Requirements-Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access method and Physical Layer Specifications
- National Fire Protection Association (NFPA):
  i. 90A-09 Standard for Installation of Air-Conditioning and Ventilation Systems
- Underwriter Laboratories Inc (UL):
  i. 486A/486B-10 Wire Connectors
  ii. 916-10 Energy Management Equipment

4 LIFE SAFETY SYSTEMS

4.1 LIFE SAFETY MINIMUM REQUIREMENTS

The minimum requirements are as under:

Table 6: Minimum requirement for Safety – The following alarms shall be intimated to Building level as well as C4.

Sl. No.	Scope / Equipment	Safety Level
1	Layer to support Service Level	**Fire detection warning alarm on reconfirm:**
		Report to Fire services
		Report to Ambulance
		Report to GIFT INFRA services
		Report to Facility managers
		Report to End Client
		Report Equipment maintenance agency
		Alert message sequence as per evacuation guidelines
		Position Building / Infra evacuation guides
2	Layer to support Management Level	**Report to Facility Managers:**
		Fault alarm on GUI
		Dirty detectors status on GUI
		SLC, PA Loop healthiness
		FACP, N/w controller healthiness
		perform regular system audit
		building performance w.r.t design parameters report
3	Layer to support Control Level	Fire alarm control panel
		Refugee floor level display, announcement
		Networked online FACPs / repeaters
		Floor level GUI
		Interfaces to other system
4	Layer to support field level	**Detectors to identify:**
		Smoke
		Heat
		Rate of raise temperature
		Flame
		fire in Voids, Shafts, Ducts
		Alert occupants:
		Strobe, hooter, exit guides
		Manual pull station
		Fire exits
		Emergency exits
5	Support third party	**Soft integration**
		FACP, GUI

Sl. No.	Scope / Equipment integration	Safety Level
		Mobile - warning, alert messages
		Telephone - warning, alert messages
		shutdown, start-up operation

Safety in buildings is ensured by proper Fire Detection and Alarm System and Public Address System as discussed in upcoming sections.

4.2 FIRE DETECTION AND ALARM SYSTEM (The system define should in line with NBC 2016)

4.2.1 Introduction

- An Intelligent Modular/ Expandable Fire Alarm System shall be provided to effect total control over the life safety services required in the building.
- The system shall be provided with Addressable fire alarm initiating, annunciating and control devices.
- The addressable and intelligent system shall be such that smoke sensors, thermal sensors, manual call points, etc., can be identified with point address with clearly defined space description.
- The FAS shall be able to recognize normal and alarm conditions, below normal sensor values that reveal trouble condition, and above normal values that indicate either an alarm condition or the need of maintenance.
- Read-out or address an actual detector location. The operator shall also be able to adjust alarm and alarm thresholds and other parameters for the smoke sensors.
- Provide a maintenance/pre-alert/fault alarm capability at smoke sensors to prevent the detectors from indicating a false alarm due to dust, dirt etc.
- Provide alarm verification of individual smoke sensors. Alarm verification shall be printed on the printer at the Control Station's printer to enhance system maintenance and identify possible problem areas.
- Each detector shall use state-of-the-art Microprocessor Circuitry with error, detector self-diagnostics and supervision programs.
- The decision on detection of the fire shall be taken at the detector level.
- Dual Ray Multi-Criteria Detectors shall be offered whereby the system logic activation is based on any three inputs from the detector i.e., smoke, fixed heat or rate of rise heat.

- Provide outputs that are addressable, i.e., outputs shall have point address. The operator shall be able to command such points manually or assign the points to Logical Point Groups (Software Zones) for pre-programmed operation.

- In the event of a fire alarm, but not in a fault condition, the following action shall be performed automatically.

  a. The System Alarm LED on the main fire alarm control panel shall flash.
  b. A local sounder shall be sounded.
  c. The LCD display on the main fire alarm control panel shall indicate all information associated with Fire Alarm condition including the type of alarm point and its location within the premises.
  d. Printing and history storage equipment shall log the information associated with the Fire Alarm Control Panel condition, along with the time and date of occurrence.
  e. All system output programs assigned via control-by-event programs that are to be activated by a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
  f. All integrated function among associated sub-systems shall be activated like tripping AHU, closing dampers, shutting power, recording of camera views, opening of the doors … etc.

4.2.2 FDAS Architecture Guidelines

An intelligent analogue addressable networkable type of fire alarm system shall be installed for GIFT area buildings.

- Fire alarm system panel shall have LCD display unit and network facility. It is proposed to have centralized monitoring panel in building centralized control command center C2 (location to be finalized with Architect and facility team head) which will ensure that all fire alarm panel details are made available at Building centralized control command center C2.

- All the information flow to the building centralized control command center C2 shall be up linked to GIFT's city control command center C4 through GIFT's cloud, web link.

- The floor plans along with detectors and modules shall be made available at building centralized control command center C2 on FDAS / BMS personal computer which has online information from networked Fire Alarm Control panels.

- Dual Ray Photo, Dual Ray Multi criteria (dual photo + Thermal) and Thermal (rate of rise) type smoke detectors shall be considered.

    1. Dual Ray Photo detectors shall be provided for all public / common areas / covered car parking areas.
    2. Dual Ray Multi criteria detectors shall be provided in kitchen and café areas.
    3. Dual Ray Multi criteria detector shall be provided for Generator room.
    4. Rate of rise heat detector for the parking area (top covered – open sides / non-ventilated)
    5. Electrical rooms and electrical shafts shall be provided with Dual Ray Photo detectors.
    6. Utility rooms like pump room shall be provided with Dual Ray Photo detectors.
    7. Break glass unit and combined electronic sounder & flasher shall be provided for each fire escape stairs, exits, lift lobbies and corridors.
    8. Complete fire alarm system shall be wired using FRLS cable.
    9. Height areas shall be provided with multi head beam detector

- The entire fire alarm system network shall be integrated with Building BMS through { BACnet / Lon / Modbus} over IP gateway. All the devices and modules of the fire alarm panel shall be made available in BMS.

- GUI on FAS floor plans reflecting all devices with their online status shall be provided with complete penetration from building level to floor level to room level.

- These FACP shall have auto dialer facility which will call up predefined numbers (minimum ten numbers) sending predefined emergency messages during the fire / emergency events.

- During emergency situation the messages shall also be sent to GIFT's city control command center C4.

- All the components provided for complete functioning of the FDAS shall confirm to international certifications like UL, CE, EN …etc.

- Submittals from the developer shall consist of product data sheets, schematic, and detail floor plans.

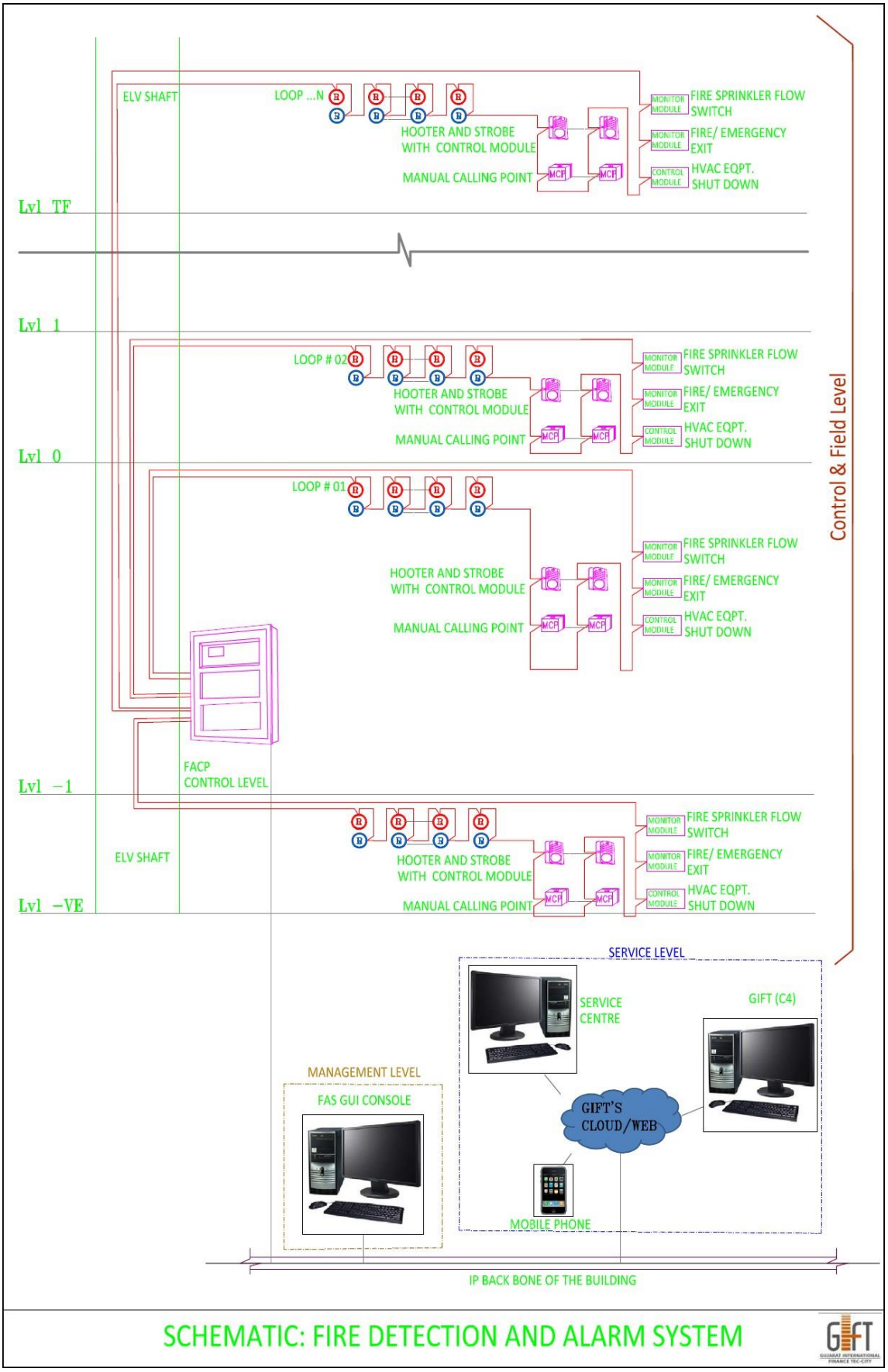


Figure 5: Typical riser schematic FDAS at GIFT Building

4.2.3 References

The publications listed below form a part of Life Safety guidelines:

- National Fire Protection Association (NFPA):
  i. NFPA 72 (National Fire Alarm Code)
- NBC 2016
- Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory
- Factory Mutual Research Corp (FM): Approval Guide,
- International Code Council, International Building Code (IBC),
- BS 5839 Part 1 & 4
- BS 5445
- EN54
- All equipment of Fire Alarm System proposed shall be approved by the Local Fire Authority
- IS 2189

4.3 EVACUATION AND PUBLIC ADDRESS SYSTEM (As per NBC 2016)

4.3.1 Introduction

- The primary objective of the system is to provide clear announcements during public addressing and one-way voice communication during an emergency; the secondary function shall be to provide background music where required.

- The system shall be capable of fulfilling the following requirements:

    1. Clear, un-distorted announcements to selected areas during public addressing.
    2. Clear, un-distorted paging to all zones; either individually or collectively. Selection of groups of zones shall be programmable from time to time; and
    3. Background music to selected areas when the other functions are not selected.

- The zones shall further be grouped according to function so that it shall be possible to make an announcement by depressing just one switch on the call station.

- To allow flexibility in the system, it shall be designed to cater for input switching. Switching of the zones shall be done on the input side, with each zone having its own channel.

- The system shall comply with country Public Address Evacuation Code of practice for the one-way emergency voice communication system in all aspects.

- All control and switching equipment shall be centralized and decentralized as specified and located in equipment racks in the emergency equipment rooms.

- All equipment supplied shall be from the same manufacturer. Equipment supplied shall strictly be Standard Products from Public Address Product Manufacturer.

- Entire system shall be IP based with on equipment DSP capability.

- Two-way communication systems shall be provided wherever necessary and called for to handle emergency situation.

All equipment offered shall comply with safety standard, CE, and other equivalent safety standard. Equipment offered without safety protection shall be subjected to rejection.

4.3.2 EPAS Architecture Guidelines

- The Evacuation and Public Mass Addressing System proposed shall operate as a facility-wide zone-based evacuation and mass public addressing system.
- Authorized person places a call from the building main security call console / in refugee floor call console by selecting the zone or zones in which a message is to be given, then presses a push-to-talk button on the microphone which activates the speakers in the selected zone or zones.
- All zones may be paged simultaneously by selecting the all-call mode.
- Authorized person may also place a call from the building facility call console (admin supervised) by selecting an all-call or zone-select mode and then presses a push-to-talk button on the microphone to activate the speakers.
- The Evacuation and mass public addressing system shall have following audio signal processing capability

    1. Background Music (BGM)
    2. Fire tone generator
    3. Message generator
    4. Mic – Announcement

- The audio processor controller shall be of IP based network controller type. The complete information arriving to networked audio processor shall be up-linked to GIFT's City Control Command Centre C4 through GIFT's Cloud, Web link.
- Ceiling, box, column, bi-directional type speaker shall be considered.

    1. Ceiling speakers for offices, lift lobbies and corridor areas (most of the false ceiling areas).
    2. Box speakers shall be provided for fire exit stairs, staff areas (non-false ceiling areas).
    3. Bi-directional speakers shall be provided car parking areas.
    4. Generator and Utility rooms like pump room, electrical room shall be provided with Box type high watt speakers.
    5. Complete Evacuation and mass public addressing system shall be wired using FRLS cable.
    6. Pro sound speakers shall be used for halls, food courts as per the application criteria.

- It is also advised to provide two-way communication systems for the LIFTs, Fire exit stairs, refugee floors, Utility areas.
- Submittals from the developer shall consist of product data sheets, schematic, and detail floor plans.

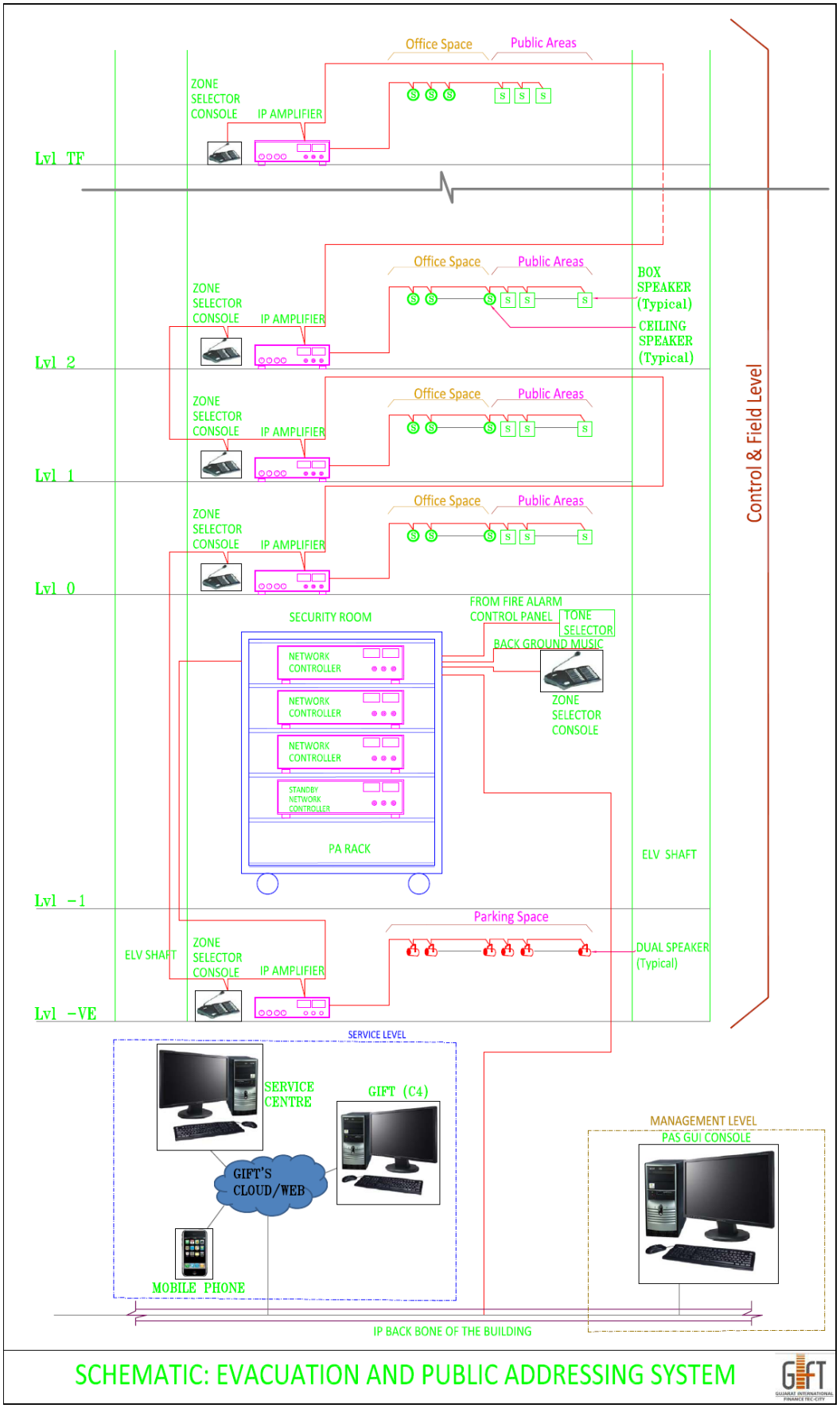


Figure 6: Typical riser schematic of EPAS at GIFT Building

4.3.3 References

The publications listed below form a part of EPAS guidelines:
AS per NBC 2016 & IS Code

- American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):
    i. RS 160-51 – Sound systems,
    ii. SE 101-A49 – Amplifier for Sound Equipment
    iii. SE 103-49 – Speakers for Sound Equipment

- American Society of Mechanical Engineers (ASME):
    i. Standard 17.4 – Guide for Emergency Personnel

- Sound System for emergency purposes
    i. IEC 60849

- EN 54

- American National Standards Institute (ANSI):
    i. S3.41 - Audible Emergency Evacuation Signal

5 SECURITY SYSTEMS

5.1 SECURITY: MINIMUM REQUIREMENTS

The minimum requirements are as under:

Table 7: Minimum requirement for Security

Sl. No.	Scope / Equipment	Description of function
1	Layer to support Service Level	**Intrusion, breach, equipment failure alarms:**
		Report to Facility managers
		Report to End Client
		Report Equipment maintenance agency
		Report to Security agencies, Police
		Report to GIFT Infra services
2	Layer to support Management Level	**Security & Surveillance reporting:**
		equipment utilization reporting
		Intrusion, breach alarms reporting
		Abnormal movement alarms
		Mob, group assembly alert
		Identification of critical zones
		Database management and backups:
		Regular database backup and cleanup unwanted data
		Disaster recovery system and remote backup
		Random online transaction audits w.r.t physical images
		Visitors, others movement, database vigilance
		Analytics
3	Layer to support Control Level	**Compound or facility access control:**
		Control compound perimeter: Electric Fences, pop-up bollards, anti-ram barriers
		Traffic control, remote controlled gates, anti-ram hydraulic drop arms, hydraulic barriers, parking control systems
		Barrier protection for man-passable openings (greater than 96 square inches) such as air vents, utility openings and culverts
		Multiple layer protection processes
		Perimeter intrusion detection systems:
		Clear zone - Video and CCTV surveillance technology
		Alarms - Detection devices (motion, acoustic, infrared)
		Personnel identification systems:
		Access control, fingerprints, biometrics, ID cards

Sl. No.	Scope / Equipment	Description of function
		Credential management
		Protection of information and data:
		Shielding of electronic security devices from hostile environments
		Computer screen shields
		Secure access to equipment, networks, hardware
4	Layer to support field level	**Security and Surveillance:**
		Employee, resident entry, and exit
		Common areas
		Visitors, others entry and exit
		Vehicle entry and exit
		Perimeter
		Public areas
5	Support third party integration	Access panels, NVR, GUI
		Mobile - warning, alert messages
		Telephone - warning, alert messages
		shutdown, start-up operation
		Mobile - access to info
		Parking guidance and management system

5.2 SECURITY SURVEILLANCE SYSTEM

5.2.1 Introduction

Essential to the security plan and design of a high-quality building is the implementation of appropriate countermeasures to deter, delay, detect, and deny attacks. Often the countermeasures work on the layered defense concept or "Onion Philosophy." This concept provides for increasing levels of security from the outer areas of the site or facility towards the inner, more protected areas. Some or all of the issues outlined below need consideration for effective security design and building operations.

5.2.2 TYPES OF threats to building security

Unauthorized Entry (Forced and Covert): Protecting the facility and assets from unauthorized persons is an important part of any security system. Some items to consider include:

Insider Threats: One of the most serious threats may come from persons who have authorized access to a facility.

Explosive Threats: Explosive threats tend to be the criminal and terrorist weapon of choice.

Ballistic Threats: These threats may range from random drive-by shootings to high-powered rifle attacks directed at specific targets within the facility (assassinations).

Weapons of Mass Destruction: Commonly referred to as WMD, Chemical, Biological, and Radiological (CBR), these threats generally have a low probability of occurrence, but the consequences of an attack may be severe.

Cyber and Information Security Threats: Businesses rely heavily on the transmission, storage, and access to a wide range of electronic data and communication systems.

5.2.3 Development and Training on Occupant Emergency Plans

Occupant Emergency Plans should be developed for all buildings Operations staff and occupants to be able to respond to all forms of credible attacks and threats. The Emergency Plan needs to include clearly defined lines of communication, responsibilities, and operational procedures parts of Emergency Plans. These plans are an essential element of protecting life and property from attacks and threats by preparing for and carrying out activities to prevent or minimize personal injury and physical damage.

Safety will be accomplished by pre-emergency planning; establishing specific functions for Operational staff and occupants; training Organization personnel in appropriate functions; instructing occupants of appropriate responses to emergency situations and evacuation procedures; and conducting actual drills to ensure everyone is aware of policies and procedures.

5.2.4 Integrated Systems

There has been a general trend towards integrating various stand-alone security systems, integrating systems across remote locations, and integrating security systems with other systems such as communications, and fire and emergency management. Some CCTV, fire, and burglar alarm systems have been integrated to form the foundation for access control.

5.2.5 SSS Architecture Guidelines

- Networked Digital CCTV system consisting of IP based fixed dome color cameras, PTZ cameras or ISCSI cameras, camera housings, supporting brackets, NVRS, storage devices, ISCSI storage devices, signal amplifiers, and video monitors shall be provided for public movement and protected areas of GIFT area buildings.
- All lift lobbies shall be provided with a fixed dome color camera focused towards lift door and lobby area.

- All main entry and exit of each area shall be provided with fixed dome color camera focusing towards entry point.
- All entry and exit to car park area of each bay shall be provided with PTZ color camera with infra-red eye / filter for night vision focusing towards entry & exit point.
- Campus main entry and exit shall be provided with PTZ color camera with infra-red eye / filter for night vision focusing towards entry & exit point.
- Hall corridors shall be provided with PTZ dome color camera of required quantity for monitoring movement
- Perimeter boundary shall be provided with PTZ color camera with infra-red eye / filter for night vision focusing towards outside.
- Emergency assembly areas shall be provided with PTZ color camera.
- NVRs shall be provided with add on recording capacity such that it can hold 1 month's data with best frames per second for scrutiny of recorded information.
- The video monitors provided shall be of Flat LCD type.
- The NVRs shall be connected to Personal computer (high end configuration) through LAN network. The CCTV Server shall archive the recorded information of each NVR on to its hard disk drive.
- Hard disk spacing shall be calculated to ensure all NVR recorded information is stored at least for a minimum period of one month.
- All cameras shall support PAL formatting. NVRs, DVRs, Monitors and video management software shall support PAL, 4CIF, MPEG, H.264 formatting.
- The complete CCTV system design shall comply with DIN/VDE, NEC, NFPA-70 standards. All components / equipment supplied shall be EN / UL / CE listed as a complete system.
- The entire CCTV system information shall be up linked to GIFT's city command center C4 through GIFT's cloud, web link.
- The technology used shall be of latest invention like half / full HD, 3D, HD3D.
- Submittals from the developer shall consist of product data sheets, schematic, and detail floor plans.

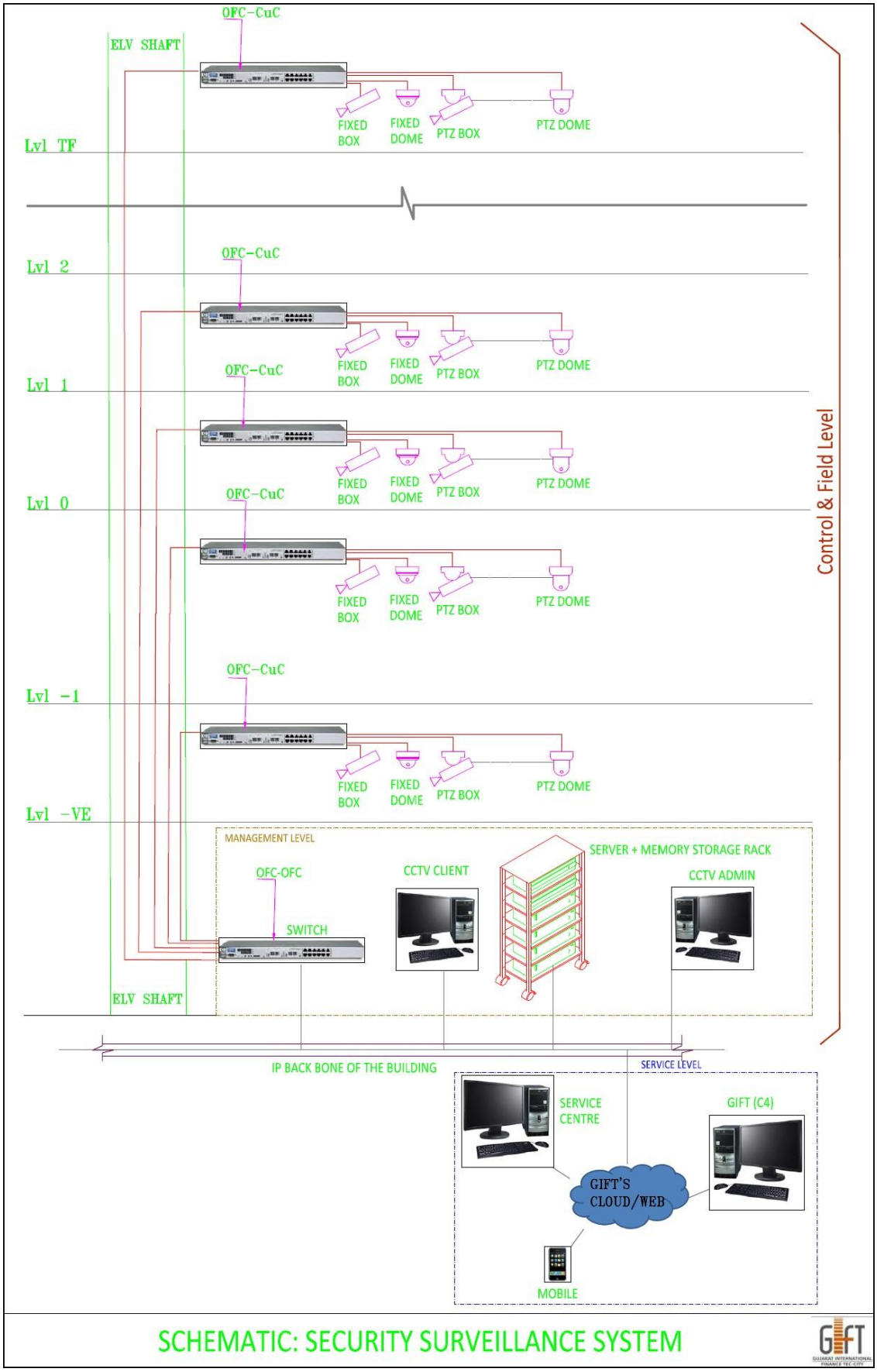


Figure 7: Typical riser schematic of SSS in GIFT building

5.2.6 References

The publications listed below form a part of CCTV guidelines:

- American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA)
  - i. 330-09 Electrical Performance Standards for CCTV Cameras
  - ii. 375A-76 Electrical Performance Standards for CCTV Monitors
- Institute of Electrical and Electronics Engineers (IEEE)
  - iii. 802.3af-08 Power over Ethernet Standard
- National Electrical Contractors Association (NECA)
  - iv. 303-2005 Installing Closed Circuit Television (CCTV) Systems
- Underwriters Laboratories, Inc. (UL):
  - v. 983-06 Standard for Surveillance Camera Units
  - vi. 3044-01 Standard for Surveillance Closed Circuit Television Equipment

5.3 ACCESS CONTROL SYSTEM

5.3.1 ACS Architecture Guidelines

- The access control system shall integrate access control, alarm monitoring (card misuse, unauthorized entry, tampering of reader) and security database management (user movement).

- A modular and network enabled architecture shall allow maximum versatility for tailoring secure and dependable access and alarm monitoring solutions for GIFT area buildings.

- Each access-controlled door shall have magnetic lock (600lbs / 1000lbs depending on door), magnetic door contact switch, emergency release switch and entry & exit card readers controlled by IP based door controller.

- All the IP based door controllers shall be networked through hub (data switch) to building access control server. The network controllers shall have complete database of all cards of the campus and their accessing (movement) details.

- Each campus user shall be provided with access card (proximity/smart type) with his details printed which itself can be used as employees ID card.

- The access software loaded on to the server (high end configuration) shall be user friendly for entering card and occupant details. It should be possible to generate required reports to track movement of any card, person ...etc.

- The access control workstation shall be installed in building centralized control command center C2.

- The complete access transaction of the access control network shall be up linked with GIFT's city command center C4 through GIFT's could, web link.

- The location of the access control doors shall be at:

    1. Computer / hub / Sever rooms
    2. Office area main entry & exit
    3. Registration area entry & exit
    4. Office cubical of importance
    5. Utility and service area office / rooms

- Each Building shall be provided and interfaced with access control system of the following:
    1. Registration entry & exit flap barrier-controlled lanes
    2. Visitor management system to track visitor's details.
    3. Parking Management and Guidance System
        a. Vehicle entry / exit:
            1. access control readers
            2. Number plate recognition
            3. Vehicle count – level wise
            4. Video surveillance
        b. Parking types:
            1. Post paid
            2. Pre-paid
            3. Temporary
            4. Complementary
            5. Quota management
        c. Cash / Billing management
            1. User / Company / Quota based
            2. Different parking types
            3. Customer account management
            4. Bill consolidations
            5. Daily collections
            6. Cash management for different users
        d. Reporting:
            1. User management
            2. Customer management
            3. In / out flow report
            4. Income report
            5. Vehicle statistics
            6. Slot query kiosk
        e. Parking guidance display, real time parking status updates
    4. Fire exits monitoring
    5. Person, baggage, or vehicle monitoring systems
    6. Metal detectors
    7. Perimeter protection system in case of campus

- The entire access control system shall be integrated with fire alarm system for emergency operation (all door open or zone wise door open during fire).
- The main entrance shall be provided with motorized gate, pop-up bollards for emergency stoppage of vehicles.
- Submittals from the developer shall consist of product data sheets, schematic, and detail floor plans.

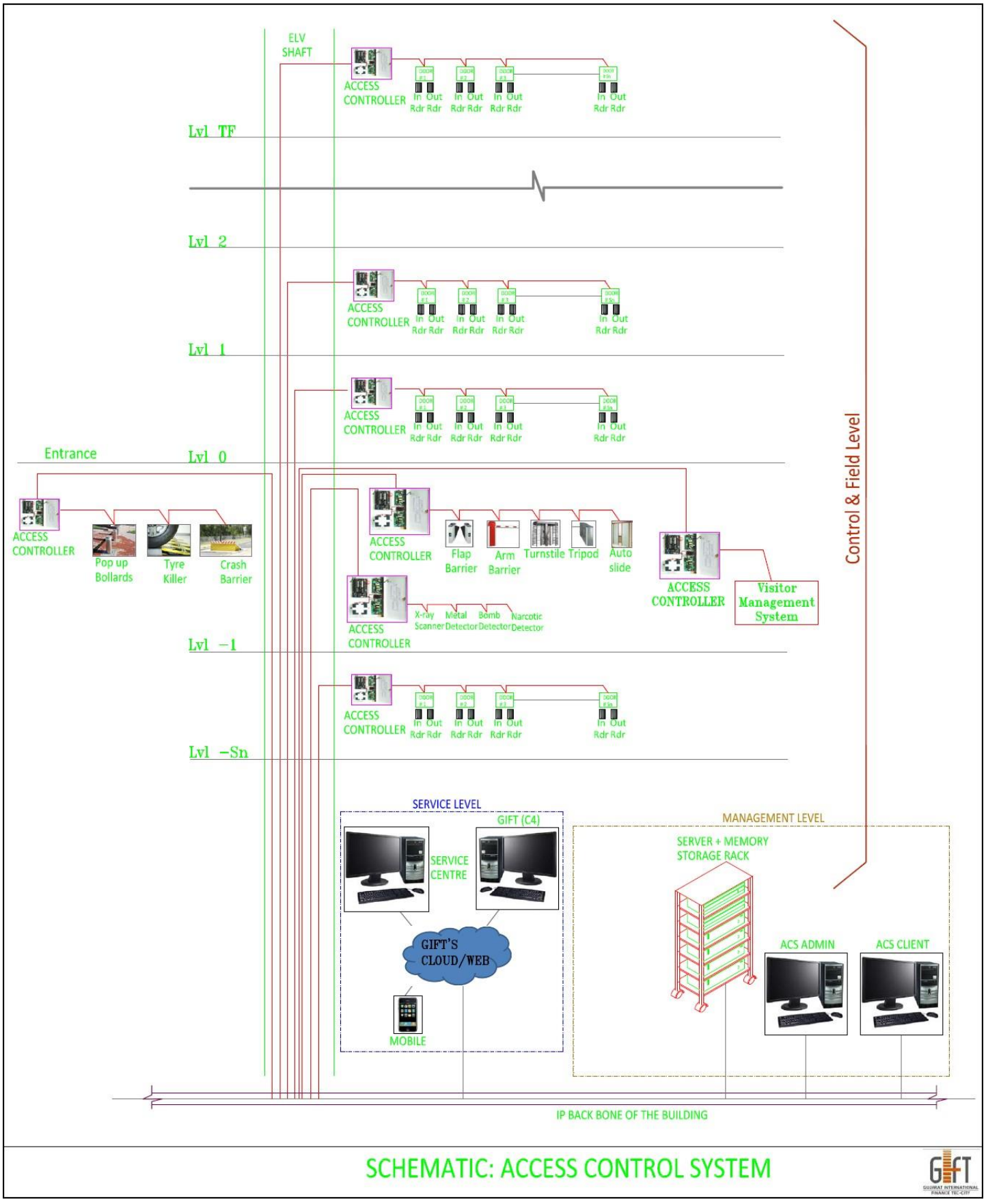


Figure 8: Typical riser schematic of Access Control System in GIFT building

5.3.2 References

The publications listed below form a part of ACS guidelines:

- American National Standards Institute (ANSI)/ Security Industry Association (SIA)
  i. AC-03 Access Control: Access Control Guideline Dye Sublimation Printing Practices for PVC Access Control Cards
  ii. TVAC-01 CCTV to Access Control Standard - Message Set for System Integration

- Underwriters Laboratories, Inc. (UL)
  iii. 294-99 The Standard of Safety for Access Control System Units
  iv. 305-08 Standard for Panic Hardware
  v. 639-97 Standard for Intrusion-Detection Units
  vi. 752-05 Standard for Bullet-Resisting Equipment
  vii. 827-08 Central Station Alarm Services
  viii. 1076-95 Standards for Proprietary Burglar Alarm Units and Systems
  ix. 1981-03 Central Station Automation System
  x. 2058-05 High Security Electronic Locks

- National Institute of Standards and Technology (NIST)
  xi. Special Pub 800-63 Electronic Authentication Guideline
  xii. Special Pub 800-96 PIV Card Reader Interoperability Guidelines
  xiii. Special Pub 800-73-3 Interfaces for Personal Identity Verification
  xiv. Special Pub 800-76-1 Biometric Data Specification for Personal Identity Verification
  xv. Special Pub 800-116 Recommendation for the Use of PIV Credentials in Physical Access Control Systems (PACS)

- International Organization for Standardization (ISO):
  i. 7810 Identification cards – Physical characteristics
  ii. 7816-1 Identification cards - Integrated circuit(s) cards with contacts
  iii. 7816-4 Identification cards - Integrated circuit cards - Part 11: Personal verification through biometric methods
  iv. 14443 Identification cards - Contactless integrated circuit cards; Contactless Proximity Cards Operating at 13.56 MHz in up to 5 inches distance
  v. 19794 Information technology - Biometric data interchange formats

6 IBMS TYPICAL REQUIREMENT FOR BUILDING, CAMPUS

For successful implementation of Intelligent Building Management System inside building, campus it is necessary that all spaces are facilitated with necessary IBMS equipment which will support the control and monitoring from building's control center (C2). Following tables provide detailed list of all equipment / interfaces required at various locations inside building, campus:

For Buildings: (Suggestive - at the discretion of the developer)

1. Individual office / end user / flat
2. Floor level common areas
3. Building utility areas
4. Ground floor lobby areas
5. Car parking area
6. Terrace
7. Energy transfer station

For Campus:

In addition to above 1-7:

8. Campus Entry / Exit and Drop Off Points

Developer necessarily needs to meet 'Essential' type requirements for all buildings. However, 'Suggestive' type features are also specified for the various sub-systems and areas.

IBMS FOR INDIVIDUAL OFFICE / END USER / FLAT **Table 8: Individual Office / End User / Flat**

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Air conditioning	Air Handling unit (floor or ceiling mount)	suggestive	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			Return air temp	Platinum temperature sensor - telescopic type	
			CHW modulating valve control & feedback	PIV Globe valve mounted with proportional valve actuator with position feedback	
			Filter status	Diff pressure switch	
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
		Suggestive	Space temp	Platinum temperature sensor - Interior decor type	
			Return RH	Capacitive type RH transmitter	
			dehumidifier & humidifier control & feedback	Heater bank, atomizer	Provision in starter of Electrical MCC Panel
			Filter clog level (DPT)	Diff pressure Transmitter	
			Condensation tray clogg		
			IAQ status	IAQ Sensor	
			Fresh & Return air damper control and feedback	fresh & return air damper mounted with proportional damper actuator with	

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
				position feedback	
			VFD for Blower		Soft integration of the VFD using BACnet / LON / Modbus protocol; VFD provided with starter of the Electrical MCC Panel
			VFD parameters (I, kW, Speed, Frequency, faults, speed control & feedback)		
	VAV, Therma diffuser		VAV, Therma diffuser soft interface (Zone temp, flow / %Operation, dP, any critical parameters)	A/c design based on VAV / Therma diffuser	Soft integration of the VAV / Therma fuser using BACnet / LON / Modbus protocol with BMS
	Fan Coil unit	Suggestive	Blower on/off command	BACnet / LON based FCU controller	Soft integration of the FCU controller using BACnet / LON protocol with BMS
			Blower Speed (low, medium, high) command		
			CHW on/off valve control & feedback		
			Fire shutoff (from FDAS)		
		Suggestive	Dehumidifier & humidifier control & feedback	Heater bank, atomizer	Provision in starter of Electrical MCC Panel
Ventilation Systems	Centralized toilet exhaust fan	Suggestive	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
					connected to starter of Electrical MCC Panel
Metering	Individual office chilled water incomer	Suggestive	Chilled water consumption	Btu meter (BACnet / LON / Modbus)	Btu meter soft integrated with BMS through Btu meter gateways (IP)
Lighting Control	Lighting controller	Suggestive	Scheduled, occupancy-based operation of the lights	Lighting controller (BACnet / LON / Modbus) for circuit management; PIR, Lux sensor for occupancy, light level sensing	Provision in light power distribution system
	Fire detection and alarm system	Essential	To detect smoke and free from false alarms	Fire detection and alarm panel (BACnet / LON / Modbus) with Smoke detectors - dual ray type	Fire detection alarm panel soft integrated with BMS
			Notification of smoke	FDAP with Strobe and	

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Life safety				Hooter - sound and flash level settable	
			Alarm initiating devices	FDAP with Manual call station / pull station	
	Electrical Panels	Essential	Protection from electrical fire; linear heat detection tube with extinguisher	lineate heat detection tube	
	Evacuation and public addressing system	Essential	To announce warning, alert, and guiding messages;	Amplifier - IP based with speakers; IP amplifier linked with Evacuation network controller	Evacuation network controller integrated with BMS
			Notification of emergency, warning, alert messages	MIC interfaced with amplifier; fire tone generator interfaced with amplifier	
Security & Surveillance	CCTV	Essential	Unit / Office Main entry / exit movement monitoring	IP Cameras, NVR-HD Recording, Server, Monitors, Surveillance software	UP-link to C2
			Unit / Office critical area movement monitoring		
	Access	Essential	Unit / Office Main entry / exit movement restriction	Smart card, card reader, Access door controller, Server, Access software	UP-link to C2
			Unit / Office critical area movement restriction		

6.1 IBMS FOR INDIVIDUAL FLOOR LEVEL COMMON AREA

Table 9: Floor level common areas

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Air conditioning	Ceiling Suspended unit / Fan Coil unit	Suggestive	Blower on/off command	BACnet / LON based FCU controller	Soft integration of the FCU controller using BACnet / LON protocol with BMS
			Blower Speed (low, medium, high) command		
			CHW on/off valve control & feedback		
			Fire shutoff (from FDAS)		
		Suggestive	dehumidifier & humidifier control & feedback	Heater bank, atomizer	Provision in starter of Electrical MCC Panel
Ventilation Systems	Centralized toilet exhaust fan	Suggestive	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
Lighting Control	Lighting controller	Suggestive	Scheduled, occupancy-based operation of the lights	Lighting controller (BACnet / LON / Modbus) for circuit management; PIR, Lux sensor for occupancy, light level sensing	Provision in light power distribution system
Life safety	Fire detection and alarm system	Essential	To detect smoke and free from false alarms	Building Fire detection and alarm panel (BACnet / LON / Modbus) interfaced with	Fire detection alarm panel soft integrated with BMS

				Smoke detectors - dual ray	

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
				type	
			Notification of smoke	Building Fire detection and alarm panel (BACnet / LON / Modbus) interfaced with Strobe and Hooter - sound and flash level settable	
			Alarm initiating devices	Building Fire detection and alarm panel (BACnet / LON / Modbus) interfaced with Manual call station / pull station	
	Electrical Panels	Suggestive	protection from electrical fire; linear heat detection tube with extinguisher	lineate heat detection tube	
	Evacuation and public addressing system	Essential	To announce warning, alert, and guiding messages;	Building Amplifier - IP based interfaced with speakers; IP amplifier linked with Evacuation network controller	Evacuation network controller integrated with BMS
			Notification of emergency, warning, alert messages	Building Amplifier - IP based interfaced with MIC and fire tone generator	
Security & Surveillance	CCTV	Essential	Unit / Office area Lift and staircase entry / exit movement monitoring	IP Cameras interfaced with Building N/w, NVR-HD Recording, Server, Monitors, Surveillance software	UP-link to C2
			Service area Lift and staircase area movement monitoring		

IBMS FOR BUILDING LEVEL UTILITY AREAS **Table 10: Building Utility Areas**

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Air conditioning	Ceiling Suspended Unit / Fan Coil unit	Suggestive	Blower on/off command	BACnet / LON based FCU controller	Soft integration of the FCU controller using BACnet / LON protocol with BMS
			Blower Speed (low, medium, high) command		
			CHW on/off valve control & feedback		
			Fire shutoff (from FDAS)		
		Suggestive	dehumidifier & humidifier control & feedback	Heater bank, atomizer	Provision in starter of Electrical MCC Panel
	CHW pumps (VFD based with pump controllers)	Essential	Pump controller BACnet / LON / Modbus soft interface with VFD parameters		Pump controller interface with BMS through Pump controller gateways (IP)
	Any Exhaust air fans	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
					Panel
	Any Fresh air fans	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
Lighting Control	Lighting controller	Essential	Scheduled, occupancy-based operation of the lights	Lighting controller (BACnet / LON / Modbus) for circuit management; PIR, Lux sensor for occupancy, light level sensing	Provision in light power distribution system
Life safety	Fire detection and alarm system	Essential	To detect smoke and free from false alarms	Fire detection and alarm panel (BACnet / LON / Modbus) with Smoke detectors - dual ray type	Fire detection alarm panel soft integrated with BMS
			Notification of smoke	FDAP with Strobe and Hooter - sound and flash level settable	
			Alarm initiating devices	FDAP with Manual call station / pull station	

	Electrical Panels	Suggestive	protection from electrical fire; linear heat detection tube with extinguisher	lineate heat detection tube	

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
	Evacuation and public addressing system	Essential	To announce warning, alert and guiding messages;	Amplifier - IP based with speakers; IP amplifier linked with Evacuation network controller	Evacuation network controller integrated with BMS
			Notification of emergency, warning, alert messages	MIC interfaced with amplifier; fire tone generator interfaced with amplifier	
Security & Surveillance	CCTV	Essential	Open area, Equipment location entry / exit movement monitoring	IP Cameras interfaced with Building N/w, NVR-HD Recording, Server, Monitors, Surveillance software	UP-link to C2
	Access	Essential	Open area, Equipment location entry / exit movement restriction	Smart card, card reader, Access door controller, Server, Access software	UP-link to C2
Central Monitoring	CHW piping leakage	Suggestive	To monitor leak in the CHW pipelines across the building	linear water leak detector	Building BMS
	CHW flow balancing		To ensure right flow and pressure is maintained for each equipment which consumes chilled water	Balancing valve and monitoring systems	
	DW piping leakage		To monitor leak in the DW pipelines across the building	linear water leak detector	

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
	DW flow balancing		To ensure right flow and pressure is maintained for each equipment which delivers domestic water	Balancing valve and monitoring systems	
	Building Weather station		Temperature, RH, wind velocity, direction, lux level … etc.	Weather station	
	Structural stability station		To detector any structural weakness		
Various Pump controls	Pump controller BACnet / LON / Modbus soft interface with VFD parameters	Essential	Various pumping application like DW distribution…etc.	Pump controller interface with BMS through Pump controller gateways (IP)	

IBMS FOR GROUND FLOOR LOBBY AREA**Table11: Ground Floor Lobby Area**

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Air conditioning	Air Handling unit (floor or ceiling mount)	Suggestive	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			Return air temp	Platinum temperature sensor - telescopic type	
			CHW modulating valve control & feedback	PIV Globe valve mounted with proportional valve actuator with position feedback	
			CHW inlet & outlet temp	Platinum temperature sensor with thermo well	
			Filter status	Diff pressure switch	
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
		Suggestive	Space temp	Platinum temperature sensor - Interior decor type	
			Return RH	Capacitive type RH transmitter	
			Dehumidifier & humidifier control & feedback	Heater bank, atomizer	Provision in starter of Electrical MCC Panel
			Filter clog level (DPT)	Diff pressure Transmitter	
			Condensation tray clog		

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
			IAQ status	IAQ Sensor	
			Fresh & Return air damper control and feedback	Fresh & return air damper mounted with proportional damper actuator with position feedback	
			VFD for Blower		Soft integration of the VFD using BACnet / LON / Modbus protocol; VFD provided with starter of the Electrical MCC Panel
			VFD parameters (I, kW, Speed, Frequency, faults, speed control & feedback)		
	VAV, Thermal diffuser	Suggestive	VAV, Thermal diffuser soft interface (Zone temp, flow / %Operation, DP, any critical parameters)	A/c design based on VAV / Thermal diffuser	Soft integration of the VAV / Thermal fuser using BACnet / LON / Modbus protocol with BMS
	Fan Coil unit	Suggestive	Blower on/off command	BACnet / LON based FCU controller	Soft integration of the FCU controller using BACnet / LON protocol with BMS
			Blower Speed (low, medium, high) command		
			CHW on/off valve control & feedback		
			Fire shutoff (from FDAS)		

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
		Suggestive	dehumidifier & humidifier control & feedback	Heater bank, atomizer	Provision in starter of Electrical MCC Panel
Ventilation Systems	Centralized toilet exhaust fan	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
Lighting Control	Lighting controller	Essential	Scheduled, occupancy-based operation of the lights	Lighting controller (BACnet / LON / Modbus) for circuit management; PIR, Lux sensor for occupancy, light level sensing	Provision in light power distribution system
Life safety	Fire detection and alarm system	Essential	To detect smoke and free from false alarms	Fire detection and alarm panel (BACnet / LON / Modbus) with Smoke detectors - dual ray type	Fire detection alarm panel soft integrated with BMS
			Notification of smoke	FDAP with Strobe and Hooter - sound and flash level settable	
			Alarm initiating devices	FDAP with Manual call station / pull station	
	Electrical Panels	Suggestive	Protection from electrical fire; linear heat detection tube with extinguisher	lineate heat detection tube	

	Evacuation and public	Essential	To announce warning, alert and	Amplifier - IP based with speakers; IP amplifier linked	Evacuation network controller integrated with BMS

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
	addressing system		guiding messages;	with Evacuation network controller	
			Notification of emergency, warning, alert messages	MIC interfaced with amplifier; fire tone generator interfaced with amplifier	
Security & Surveillance	CCTV	Essential	Main entry / exit movement monitoring	IP Cameras, NVR-HD Recording, Server, Monitors, Surveillance software	UP-link to C2
			Critical area movement monitoring		
	Access		Main entry / exit movement restriction	Smart card, card reader, Access door controller, Server, Access software	UP-link to C2
			Critical area movement restriction		
			Barriers for entry into the lobby area	Flap barriers with smart card readers	
			Lift access Through smart card reader	Lift provided with access smartcard reader	
			Entry Security equipment - metal detector	Metal detector with interface to access system	
			Visitor management system	to regulate visitors	

6.2 IBMS FOR TERRACE COMMON AREA

Table 12: Terrace Common Area

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Ventilation	Centralized toilet exhaust fan	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status	Diff pressure switch / Current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
	Any Exhaust air fans	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status	Diff pressure switch / Current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
	Any Fresh air fans	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow), Trip, Auto status	Diff pressure switch / Current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
Air conditioning	Ceiling suspended unit	Suggestive	Blower on/off command		

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
			Blower Run (air flow), Trip, Auto status		
			CHW modulating valve control & feedback		
			CHW inlet & outlet temp		
			Filter status		
			Fire shutoff (from FDAS)		
		Suggestive	dehumidifier & humidifier control & feedback		
			IAQ sensor		
			VFD for Blower		
			VFD parameters soft interface (I, kW, Speed, Frequency, faults, speed control & Feedback, remote,		
	Fan Coil unit	Suggestive	FCU controller soft interface	BACnet / LON based FCU controller	Soft integration of the FCU controller using BACnet / LON protocol with BMS
			Blower on/off command		
			Blower Speed (low, medium, high)		

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
			command		
			CHW on/off valve control & feedback		
			Fire shutoff (from FDAS)		
		Suggestive	dehumidifier & humidifier control & feedback	Heater bank, atomizer	Provision in starter of Electrical MCC Panel
	DX system	Suggestive	On/off command & Status of the individual equipment		
	Treated Fresh Air Handling unit (floor mount)	Suggestive	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status	Diff pressure switch / Current transducer	Provision in starter of Electrical MCC Panel
			Supply air temp	Platinum temperature sensor - telescopic type	
			CHW modulating valve control & feedback	PIV Globe valve mounted with proportional valve actuator with position feedback	
			CHW inlet & outlet temp	Platinum temperature sensor with thermo well	

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
			Filter status	Diff pressure switch	
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
Lighting Control	Lighting controller	Essential	Scheduled, occupancy-based operation of the lights	Lighting controller (BACnet / LON / Modbus) for circuit management; PIR, Lux sensor for occupancy, light level sensing	Provision in light power distribution system
Life safety	Staircase pressurization fan	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow), Trip, Auto status	Diff pressure switch / Current transducer	Provision in starter of Electrical MCC Panel
			Fire signal (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
	Lift well pressurization fan	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status	Diff pressure switch / Current transducer	Provision in starter of Electrical MCC Panel
			Fire signal (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
	Fire detection and alarm system	Essential	To detect smoke and free from false alarms	Fire detection and alarm panel (BACnet / LON / Modbus) with Smoke detectors - dual ray type	Fire detection alarm panel soft integrated with BMS
			Notification of smoke	FDAP with Strobe and Hooter - sound and flash level settable	
			Alarm initiating devices	FDAP with Manual call station / pull station	
	Electrical Panels	Suggestive	protection from electrical fire; linear heat detection tube with extinguisher	lineate heat detection tube	
	Evacuation and public addressing system	Essential	To announce warning, alert and guiding messages;	Amplifier - IP based with speakers; IP amplifier linked with Evacuation network controller	Evacuation network controller integrated with BMS
			Notification of emergency, warning, alert messages	MIC interfaced with amplifier; fire tone generator interfaced with amplifier	

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
	Evacuation and public addressing system	Essential	**Two-way communication system**		
	Lightening protection System	Essential	Protect Building from Lightening strike and destruction to Electrical installations	Lightening arrestors and associated system	Interfaced to BMS
Security & Surveillance	CCTV	Essential	Open area, Equipment location entry / exit movement monitoring	IP Cameras interfaced with Building N/w, NVR-HD Recording, Server, Monitors, Surveillance software	UP-link to C2

6.3 IBMS FOR ENERGY TRANSFER STATION

Table 13: Energy Transfer Station

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Air conditioning	Primary District cooling incomer	Essential	DCS Heat exchanger CHW inlet BTU Monitoring (flow, inlet & outlet temp, monthly consumption recording)	Btu meter (BACnet / LON / Modbus)	Btu meter soft integrated with BMS through Btu meter gateways (IP)
	Secondary District cooling incomer	Essential	DCS Heat exchanger CHW outlet BTU Monitoring (flow, inlet & outlet temp, monthly consumption recording)	Btu meter (BACnet / LON / Modbus)	Btu meter soft integrated with BMS through Btu meter gateways (IP)
			Heat exchanger inlet and outlet CHW control valve control & feedback	Globe valve mounted with proportional valve actuator with position feedback	
	Ventilation air fans	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
	Electrical Panels	Suggestive	protection from electrical fire; linear heat detection tube with extinguisher	lineate heat detection tube	
Security & Surveillance	CCTV	Essential	ETS entry / exit movement monitoring	IP Cameras interfaced with Building N/w, NVR-HD Recording, Server, Monitors, Surveillance software	UP-link to C2

6.4 IBMS FOR CAR PARKING AREA

The Parking Management & Guidance Schematic at Entry / Exit of Building Basement is provided in the following schematic and table:

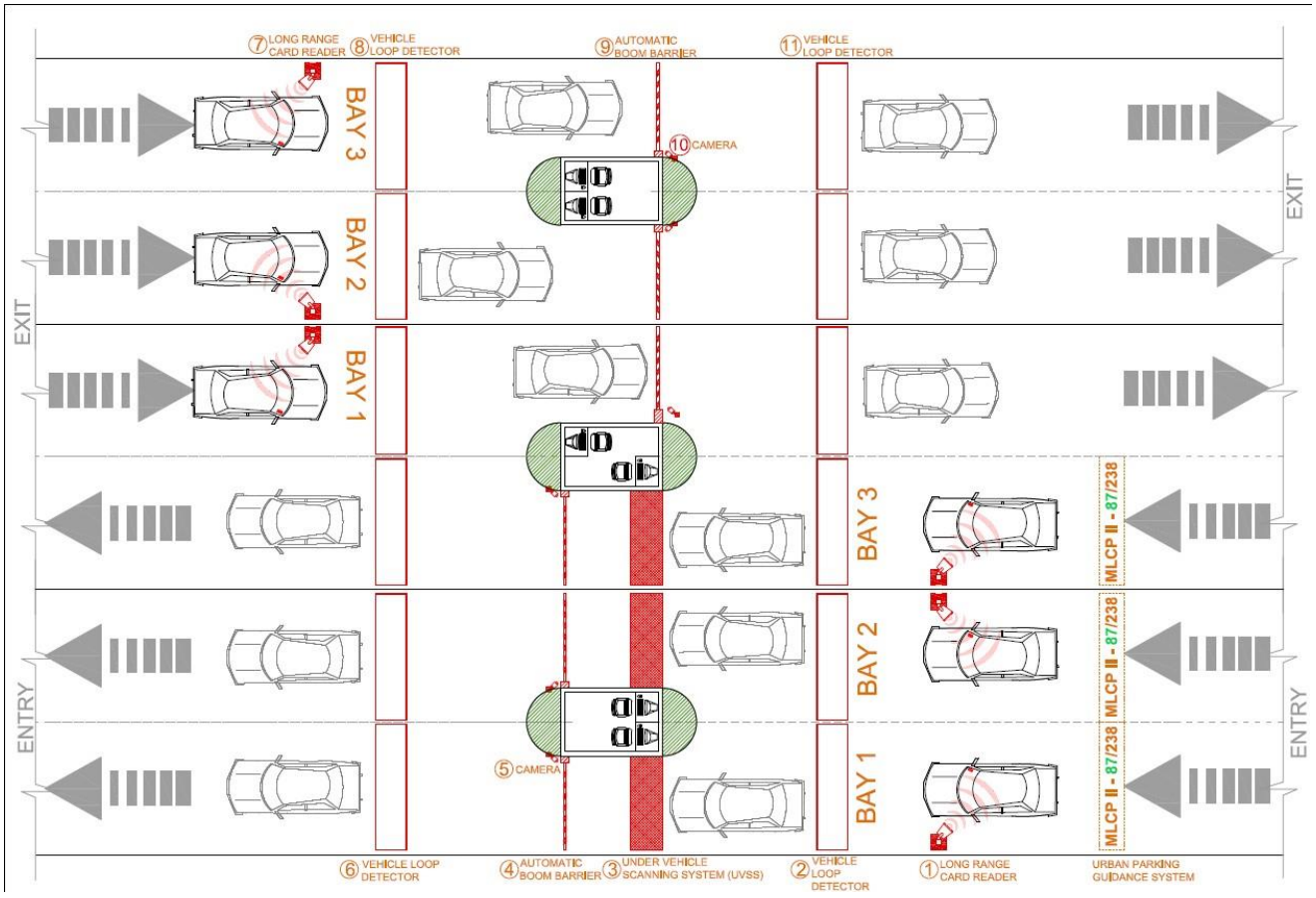


Figure 9: Parking Management & Guidance Schematic at Entry / Exit of Building Basement

Table 14: Car Parking Area

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Ventilation Systems	Car parking ventilation system (Jet, freshand exhaust air fans)	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status	Diff pressure switch / current transducer	Provision in starter of Electrical MCC Panel
			CO level monitoring	CO sensor	
			Fire signal (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
	Any Exhaust air fans	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status		Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel
	Any Fresh air fans	Essential	Blower on/off command		Provision in starter of Electrical MCC Panel
			Blower Run (air flow / current), Trip, Auto status		Provision in starter of Electrical MCC Panel
			Fire shutoff (from FDAS)		FDAS control module connected to starter of Electrical MCC Panel

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Lighting Control	Lighting controller	Essential	Scheduled, occupancy-based operation of the lights	Lighting controller (BACnet / LON / Modbus) for circuit management; PIR, Lux sensor for occupancy, light level sensing	Provision in light power distribution system
Life safety	Fire detection and alarm system	Essential	To detect smoke and free from false alarms	Fire detection and alarm panel (BACnet / LON / Modbus) with Smoke detectors - dual ray type	Fire detection alarm panel soft integrated with BMS
			Notification of smoke	FDAP with Strobe and Hooter - sound and flash level settable	
			Alarm initiating devices	FDAP with Manual call station / pull station	
	Electrical Panels	Suggestive	protection from electrical fire; linear heat detector with extinguisher	Linear heat detector	
	Evacuation and public addressing system	Essential	To announce warning, alert, and guiding messages;	Pro sound / Regular DSP Amplifier - with speakers; amplifier linked with Evacuation network controller	Evacuation network controller integrated with BMS
			Notification of emergency, warning, alert messages	MIC interfaced with amplifier; fire tone generator interfaced with amplifier	

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Security & Surveillance	CCTV	Essential	Open area, location entry / exit movement monitoring	IP Cameras interfaced with Building N/w, NVR-HD Recording, Server, Monitors, Surveillance software	UP-link to C2
	Access Controller	Essential	Car Park to Lift lobby or stairs entry / exit movement restriction	Smart card, card reader, Access door controller, Server, Access software	UP-link to C2
		Suggestive	Employee and visitor entry / exit lane	Long range proximity card reader, proximity card for the employee cars, entry vehicle loop detector, under vehicle scanner, boom barrier, exit vehicle loop detector, manned toll counter with parking management and guidance client system	Linked to building access control system @ C2
		Suggestive	Car parking management and guidance system master	Management information	UP-link to C2
		Suggestive	Car parking area	Shall be provided with guidance and signage system	Linked to building access control system @ C2

Table 15: Campus Main Entry / Exit and Drop Off Points

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Lighting Control	Lighting controller	Essential	Scheduled, occupancy-based operation of the lights	Lighting controller (BACnet / LON/ Modbus) for circuit management; PIR, Lux sensor for occupancy, light level sensing	Provision in light power distribution system
Life safety	Evacuation and public addressing system	Essential	To announce warning, alert, and guiding messages;	Pro sound / DSP Regular Amplifier - with speakers; amplifier linked with Evacuation network controller	Evacuation network controller integrated with BMS
			Notification of emergency, warning, alert messages	MIC interfaced with amplifier; fire tone generator interfaced with amplifier	
Security & Surveillance	CCTV	Essential	Main entry / exit movement monitoring	IP Cameras, NVR, Server, Monitors, Surveillance software	UP-link to C2
			Critical area movement monitoring		
Notification Signage	Signage display units	Essential	Notification of events, list of exhibitors, route map etc.	Signage display units	UP-link to C2

6.5 IBMS FOR MISCELLANEOUS AREAS

Adequate measures shall be taken to ensure efficient IBMS at miscellaneous areas (e.g., perimeter, landscape, water bodies etc.) mentioned in the table below:

Table 16: Miscellaneous (Perimeter Security, Landscape, Water bodies etc.)

Scope	Equipment	Requirement Type	Description of function	Instrument	Interface
Perimeter Security	Access Controller + RFID Sensors	Suggestive	To detect intrusion or trespass	Access Controller + RFID transmitter and receiver	Up-link to C2
Landscape	Micro Drip Irrigation + Temperature Controllers + Valve actuators	Suggestive	To supply water for irrigation by detecting soil temperature.	Drip irrigation + Temperature Controllers + Valve actuators	Up-link to C2
Water Bodies/Fountains	Pump controllers	Suggestive	To supply water for water bodies and fountains.	Pump controllers	Up-link to C2

7 IBMS Typical Requirements For Parking Area

7.1 GIFT PARKING PLAN

Parking areas are located at the building level, multi-level parking (MLP) and block level parking.

In GIFT, the following provisions are made pertaining to parking areas and its management and guidance system

1. Indoor Parking in building envelope (basement / stilts), multi-level car parking (MLP)

2. Outdoor Parking in blocks

3. Urban Parking Management and Guidance System

The GIFT Area GDCR provides the parking standards for different land uses. The total parking requirement shall be met within the Building Envelope and remaining by purchasing in the common multi-level parking.

The parking provision within the Building Envelope shall be at basement level or at stilt level. In some blocks like the Exhibition Centre, the block level parking may be required to be provided.

As per the GIFT master plan, seven Multi level Parking complexes are envisaged to cater to the parking demand.

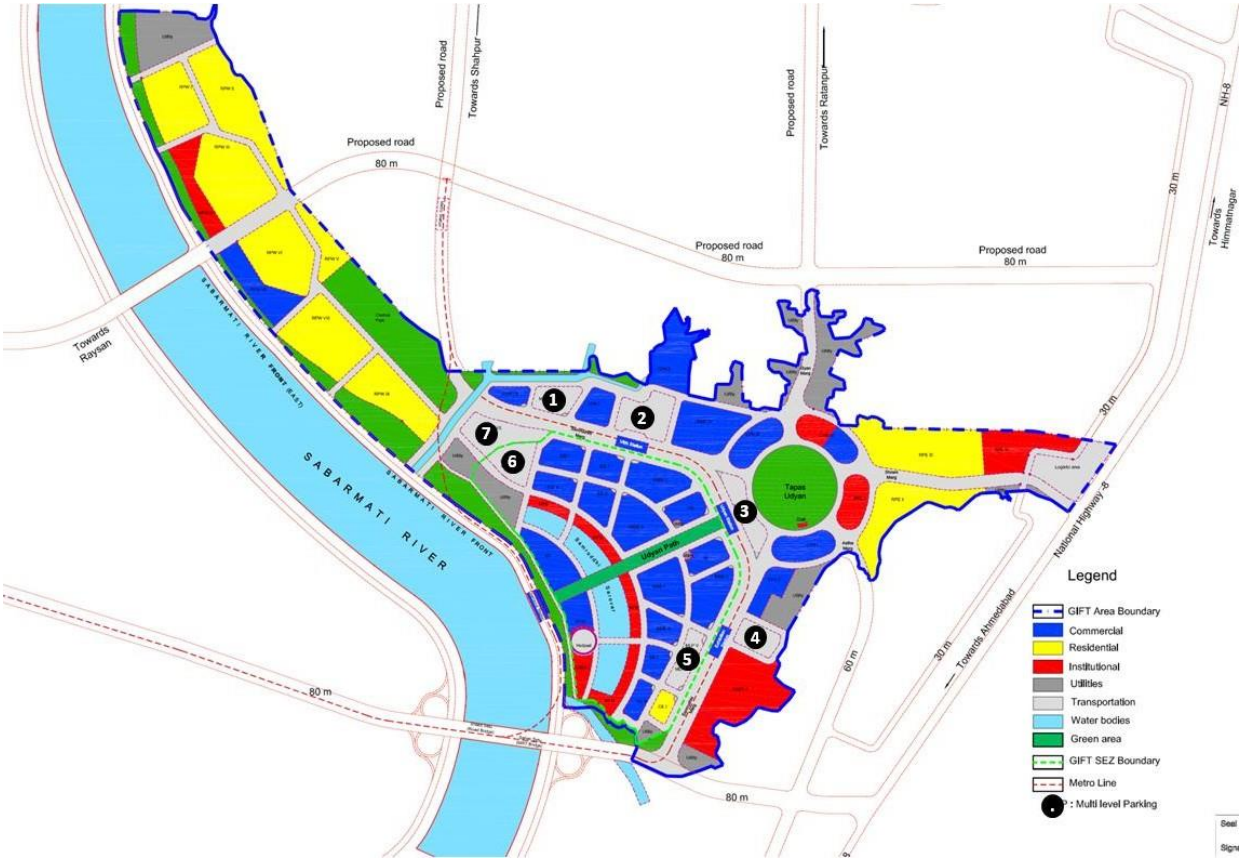


Figure 10: GIFT – MLP Locations

(Updated Master Plan)

7.2 INTEGRATED INTELLIGENT PARKING

GIFT envisions to adopt intelligent parking guidance and management systems.

To aim at efficient usage and performance of the MLP parking infrastructure by the varied users, the MLP's would be integrated.

Parking Guidance and Management System at the city level would be deployed that would integrate the various MLPs to be developed over a period.

Integrated Parking would increase productivity and revenue by delivering just-in-time information where it is needed.

The following section will provide details of typical IBMS requirements for indoor parking in a Block which will cater to private, emergency, service, and other important vehicles. The Block parking systems shall synergize and integrate with the GIFT parking system.

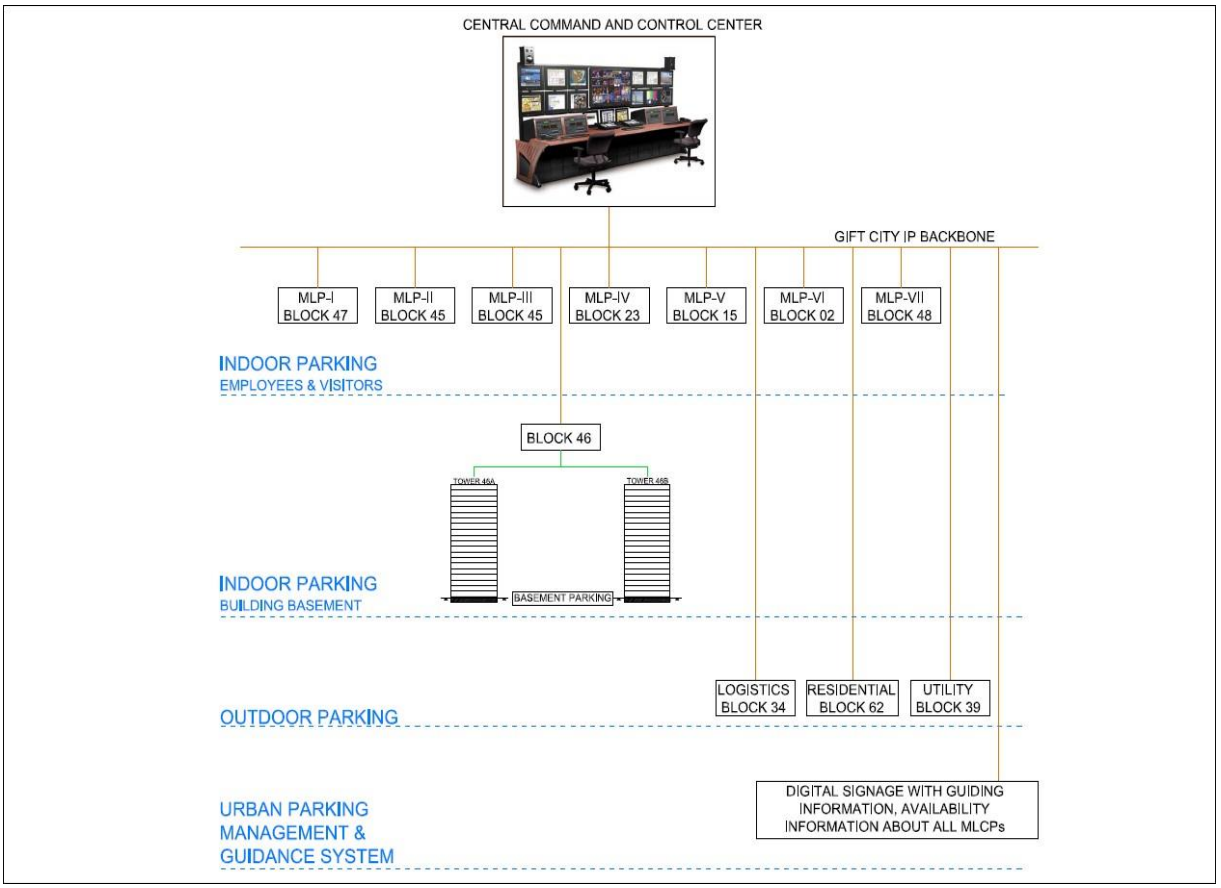


Figure 11: GIFT Area Parking Management and Guidance Schematic

To achieve the envisioned vision of GIFT, the overall typical IBMS from a Smart City Development approach for MLP are specified as being (a) Essential and (b) Suggestive.

7.2.1 Essential IBMS for MLP

Essential requirements are those that have to be provided by the Developer. For Essential requirements refer Chapter 3 (Building Management Systems), 4 (Life Safety Systems), 5 (Security Systems), 6 (Typical Requirements for Buildings for the respective areas) of this document for the residential building.

The other Essential Requirements include the following:

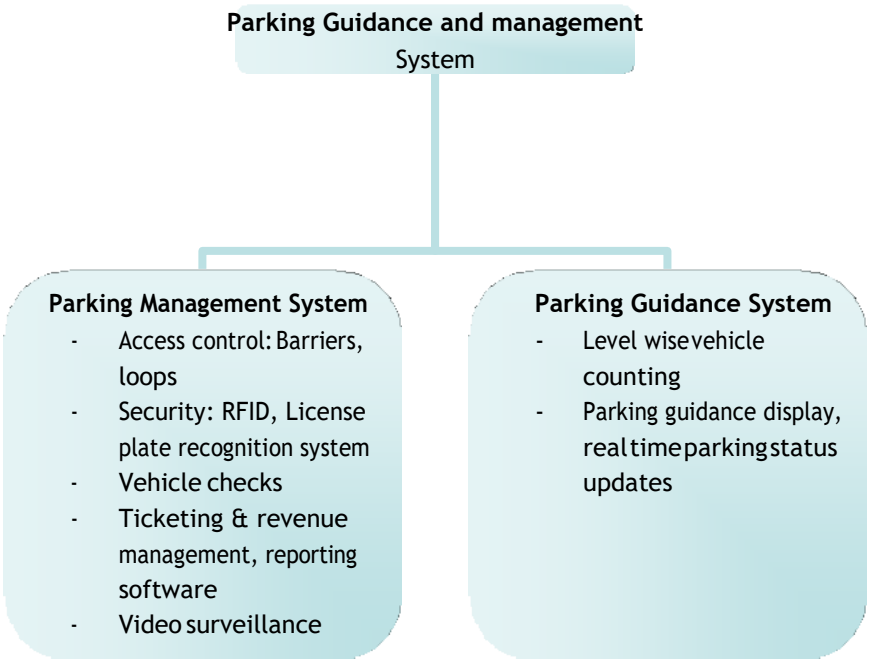
1 Parking Management and Guidance System:

The advent of multi-level car parks has made the management, revenue and security of car parks the topmost priority.

A. **Parking guidance system** help people to find empty parking slot quickly, thereby reducing frustration and enhancing the visitor's / user's experience. Parking guidance system indicates free spaces available at

every level, bay in real time resulting efficient means of revenue management system.

B. **Parking management system** constitutes the access control, revenue management, security, and statistical information systems.



A Parking Guidance System

- Parking guidance system shall aim to help users to find empty parking slot quickly, thereby enhancing the visitor's / user's experience. Parking guidance system shall indicate occupied / free / reserved spaces available at every level, bay in real time resulting efficient means of revenue management system.

- Parking guidance system shall direct motorists to the nearest available parking spaces by the shortest route and inform motorists and management of the occupancy status throughout the parking facility. This shall be accomplished through the use of detectors, signage, and software.

- An ultrasonic detector, equipped with LED pilot lights, shall be installed via hardwired bus way above each parking space. The detectors shall constantly (two to three times per second) check for the presence of a vehicle and immediately indicate the presence of a vehicle by changing the color of its LED pilot lights from GREEN to RED.

- The detector's observations shall be communicated to a centralized access control system. The access control system shall process the information and updates strategically placed signs to inform motorist of the occupancy status of the level or entire parking facility.

- Directional LED signs, comprising of combinations of directional arrows and numerals, shall be employed to direct motorist to the first available vacant parking space. The signs shall be constantly updated to provide accurate and reliable information. Space detectors placed along with each sign to account for cars traveling to and from parking spaces.

- Reader boards shall be placed on the roadway leading to the parking facility will display the availability of parking spaces on each level of the MLP.

- Summarily, the information provided at each level (refer figure 13) is described in this section:

    - On entering the car parking area main entry signage will guide number of slots available at each level.

    - On entering desired level, current available slots will be displayed in the entry.

    - Once vehicle enters the bay, bay signages will guide slots available at various bays.

    - User is guided to the closest slot by guidance system.

    - On parking the vehicle, slot indicator turns to occupied mode and bay and all entry signages are updated (count decrement by one).

    - On exiting from the slot again bay and entry signages are updated (count incremented by one).

- The access control software shall operate on a Microsoft Windows XP / Windows 7 / windows latest version Professional operating system. It shall assign a unique address to each detector and monitors the status of its corresponding parking space 2 to 3 times per second. The result shall be real-time status data that is communicated to motorist though signage and monitored by management. The parking status information shall be compiled into a database which is the source of custom operations settings and a variety of management reports.

- The access software can be customized to set and change conditions that automatically control the availability of reserved parking in specified zones for specified times and dates. The access control software shall be

compatible with parking control apparatus including access and revenue control systems via TCP/IP open commutations protocol.

- Following valuable parking management reports shall be available:
    - Number of Occupied Spaces
    - Dwell Time Turnover Rate
    - Notification of Vehicles Exceeding Parking Limits
    - Peak / Seasonal Occupancy Data
- Reports shall be customized to meet the specific needs of the MLP.

B Parking Management System

Parking Management system shall support the following aspects:

Vehicle entry / exit:

- Using access control readers
- Number plate recognition
- Counting by RFID loops
- Video surveillance

Parking types:

- Post paid
- Pre-paid
- Temporary
- Complementary
- Quota management

Cash / Billing management:

- User / Company / Quota based
- Different parking types
- Customer account management
- Bill consolidations
- Daily collections
- Cash management for different users

Reporting:

- User management
- Customer management
- In / out floe report

- Income report
- Vehicle statistics
- Slot query kiosk

2 Employee vehicle entry / exit lane

Employee vehicle entry / exit lane shall be clearly identified with large signage visible from long distance mentioning that "Employee with vehicle access card only", so that traffic flow on these lanes are continuous without any disturbance to flow.

The sequence of equipment involvement shall be in following order for granting entry and exit (Refer figure 12):

- Employee vehicle recognized using long range proximity card reader.
- Entry counter initiated by entry vehicle loop detector.
- Under vehicle scanning done by toll supervisor.
- Permission granted if valid vehicle access card and no unacceptable objects found by opening boom barrier.
- If any unacceptable object found, then vehicle is called for inspection. On clearing the inspection, vehicle is allowed to enter the premises.
- Exit counter acknowledges vehicle passed and count incremented.
- Boom barrier closed for the next cycle.

3 Visitor vehicle entry / exit lane

Visitor vehicle entry / exit lane shall be clearly identified with large signage visible from long distance mentioning that "Visitor with no vehicle access card only". This lane will take more time to clear the vehicle due to mandatory checking and visitor toll process.

The sequence of equipment involvement shall be in following order for granting entry and exit (Refer figure 12):

- Entry counter initiated by entry vehicle loop detector.
- Under vehicle scanning done by toll supervisor.
- Visitor issued with long range proximity card reader with validity (number of hours).
- Permission granted if no unacceptable objects found by opening boom barrier.
- If any unacceptable object found, then vehicle is called for inspection. On clearing the inspection, vehicle is allowed to enter the premises.
- Exit counter acknowledges vehicle passed and count incremented.
- Boom barrier closed for the next cycle.
- Visitor vehicle recognized using long range proximity card reader and the hour count decrements.

4 Automatic Boom Barrier

Automatic barrier shall support arm length of required size (max 6.5 mtrs). Usage frequency shall be 100%. Opening /closing time shall be maximum of 1.4 seconds. Actuating system shall consist of hydraulic pump unit, plunger pistons, equalizer, and transmission shaft. Balancing shall be affected by compression spring. Internal stops shall be provided to adjust for open or closed beam positions. Load bearing housing shall be made of steel and shall be protected by cataphoresis treatment and polyester powder paint.

The barrier shall support protection class applicable for outdoor application. Electric motor power supply shall be as per Indian standard 230 Vac, 50 Hz. The barrier shall have built-in electronics controller board, provision for connecting infra-red photocell / loops for perfect integrated entry / exit control mechanism.

5 Long Range Smart Card Reader

Contactless Smart Card Reader shall be used for installations incorporating parking control and long read range applications. The Long-range smart card reader shall package all the electronics in one rugged, attractive, and easy-to install housing.

The contactless smart card long range reader shall give advantage of longer read range of proximity with the power and heightened security of smart card technology, making it an ideal for access control applications.

It shall have high intensity LED for clear visual feedback even in direct sunlight. Distinct tone sequences shall indicate status conditions.

- Long read range distance (up to 18 inches or 45 centimeters)
- Shall have the following features:
    - Auto tuning for more consistent read ranges
    - "Parking Hold" feature allows connection to a loop detector to ensure accurate detection of vehicles in parking lanes.
    - With a multicolor LED and beeper which can be controlled internally or at host.

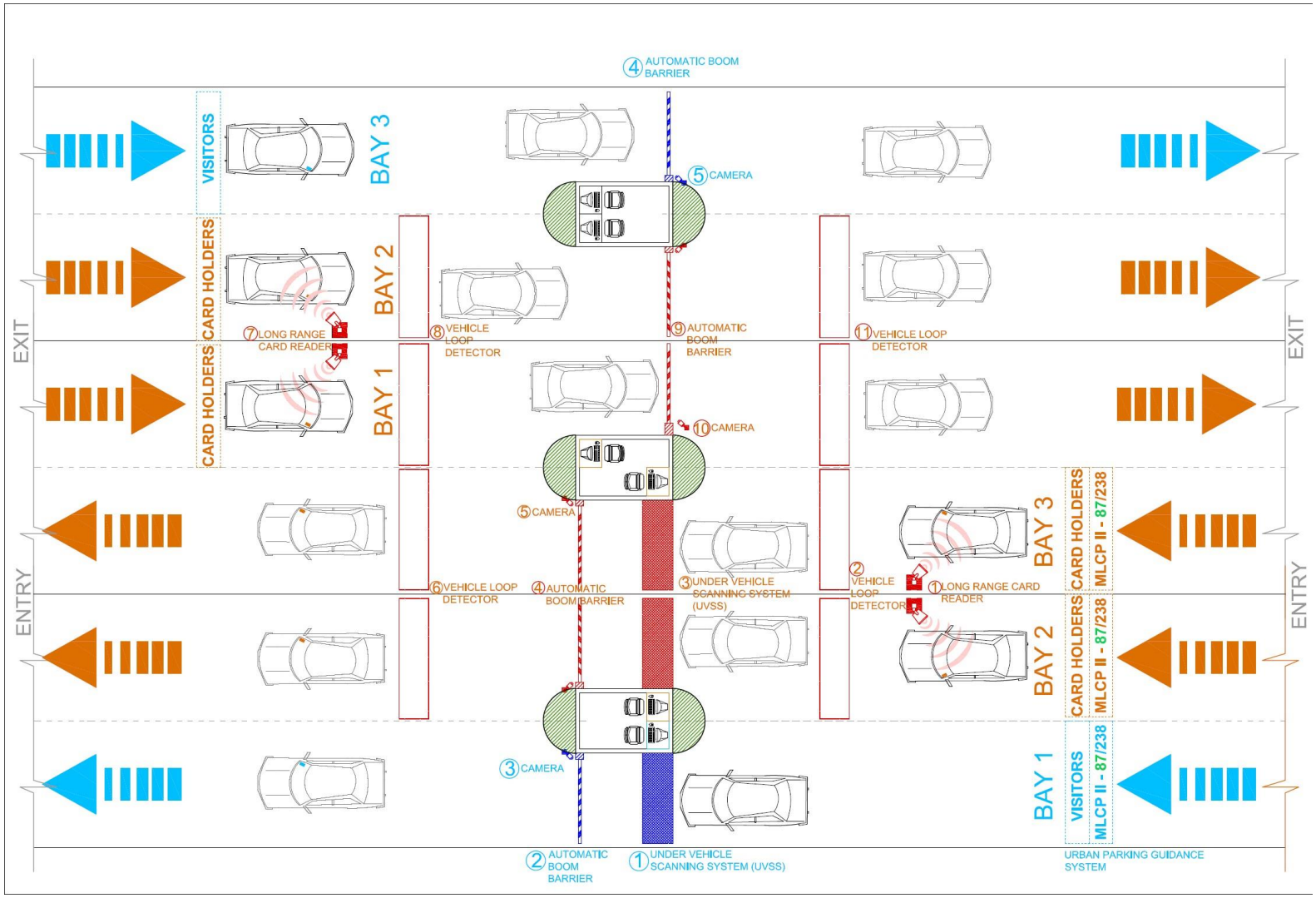


Figure 12: Parking management and Guidance Schematic at MLP Entry / Exit

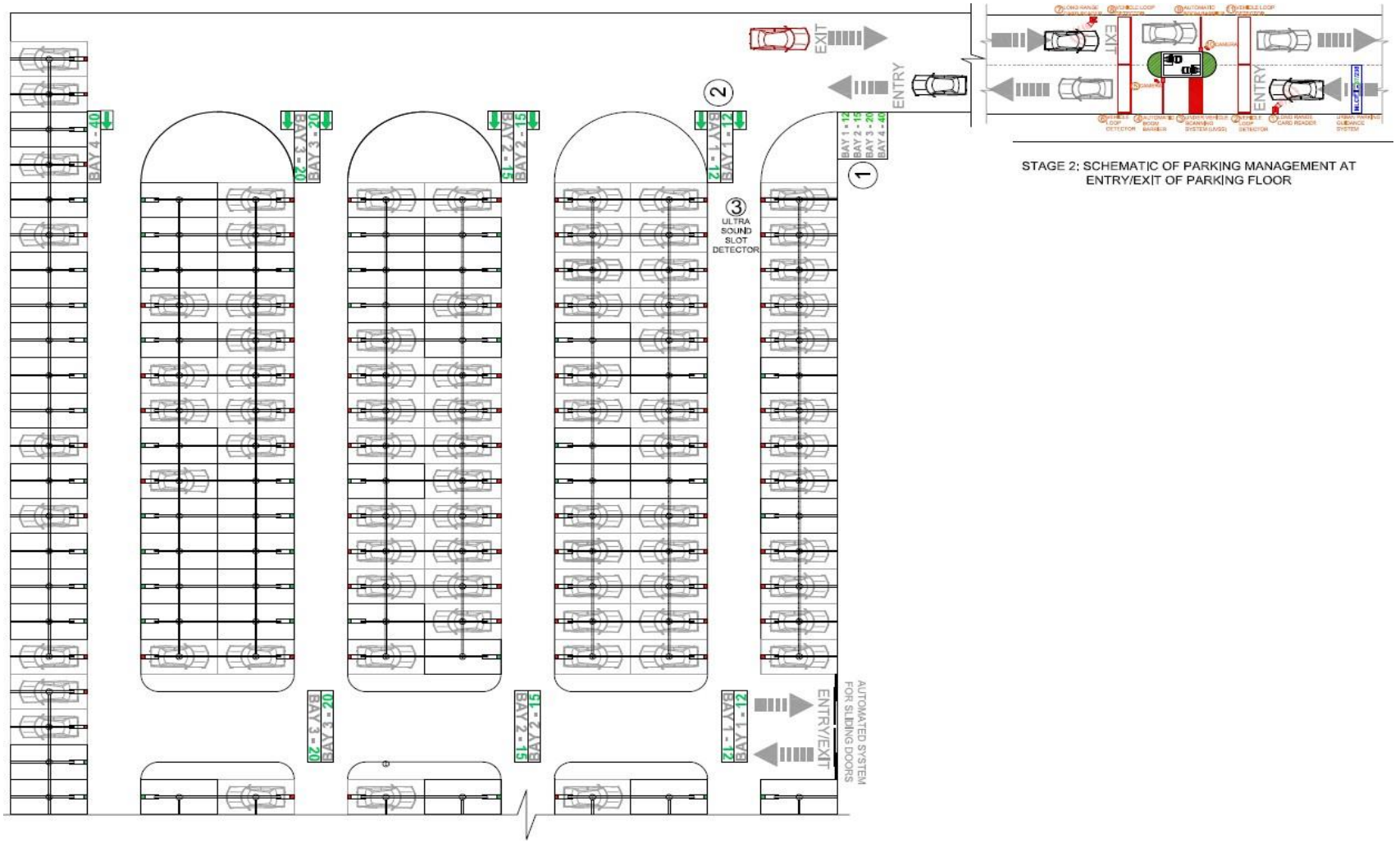


Figure 13: Parking Management and Guidance Schematic at Parking Floor Level

7.2.2 Suggestive Features for MLP

The following section specifies the Suggestive Features for MLP from a Smart City Development Approach.

The typical parking equipment requirements for MLP is provided as follows:

1. **Infra-red photo sensor:**

   The infra-red photo sensor, non-contact type shall be used to assist gate operators for identifying approach of the vehicle towards gate. The infra-red photo sensor shall comply with the UL 325 standard when used with steel hoods. The infra-red transmitter and receiver shall be mounted in line of site at a distance of up to 65 feet. When the infrared beam is broken the infra-red photo sensor produces a detection signal.

2. **Vehicle Loop Detector:**

   The vehicle loop detector shall be provided and designed for easy installation and operation. It shall provide maximum surge protection on all inputs and outputs of the detector. The vehicle loop detector shall have the following features:

   - Loop diagnostics
   - Loop isolation transformer
   - Loop conditioner
   - Aluminum RF shield housing
   - Loop frequency counter
   - Sensitivity controls
   - Function controls
   - Controls for frequency, reset & frequency counter
   - Intensity LED indicators
   - relays pulse or presence
   - Include PR-Loop

3. **Automated system for Sliding doors:**

   The automated system for sliding doors shall be chosen to meet the traffic needs of the space it is serving for and shall also protect our environment. The automation system shall have innovative “Energy Saving” device to identify the direction of transit and perfectly optimize opening / closing times to avoid unnecessary air dispersion, even in case of sideways transit.

   The automation system for sliding door shall feature an Ethernet interface for setting the operating parameters of the automated system and viewing the fault diagnostics through centralized monitoring access control system of the

premises. The automated system for sliding door shall be customizable and modular to meet the architectural and technical needs of the Client.

The automated system for sliding door shall be chosen to meet following minimum criteria:

Opening speed (adjustable)	:	5 to 160 cm/sec.
Closing speed (adjustable)	:	5 to 140 cm/sec.
Partial opening adjustment	:	10% to 90% of total opening
Pause Time adjustment	:	0 to 30 sec.
Night pause Time adjustment	:	0 to 240 sec.
Anti-crushing device	:	standard
Photocells fail safe	:	standard

The automated system for sliding door shall support software tool that allows quantifying energy savings in terms of both economic savings and reduction of CO2 polluting emissions, based on the dimensional characteristics and the geographical position of the automated entrance.

4. Under vehicle scanning system (UVSS):

UVSS shall aid security agencies to conduct quick and thorough inspection of all vehicle types (e.g., cars, MUV, Vans, trucks, Cargo vehicles, heavy vehicles). The UVSS shall support wide height and length of the vehicles. The UVSS shall support detection of the following:

Explosive	:	Semtex, TNT, C4, Ammonium nitrate based explosives and more.
Chemical elements	:	Phosphorus, Arsenic, Fluorine, Chlorine, Sulphur, Sodium and more
Drugs	:	Cocaine, Heroin, Ecstasy and more

The UVSS system shall support operator in determining intensity of the threat in real time basis. The technology used shall support chemical composition and estimation of mass of the dangerous material.

UVSS shall possess following features:

- Unsurpassed image quality, high resolution, photo- quality scanned under vehicle image
- Automatic detection of foreign objects
- Rapid response on improvised explosive device threats
- Multi point networked intelligence
- Seamless integration with complementary systems

5. Crash rated Electric Bollards:

The usage of emerging industry trends in ALL ELECTRIC, GREEN, bollard systems envisaged in critical entry / exit areas. The Electric Bollard shall be precision engineered, improved duty cycles, acceptable operating speeds, smooth quiet efficiency, and overall lower maintenance costs.

The Electric bollards shall be powder coated or composite stainless-steel finish as standard. It may be suggested to provide custom decorative sleeves for an aesthetically pleasing security solution.

The Electric barrier shall have PLC controlled for easy programming and integration into overall perimeter control systems. The complete drive system shall be electric. The Electric Bollard shall use clean, proven, and reliable electric motors alleviating all of the operational maintenance and costs associated with hydraulic devices. Servo electric motor systems have incredibly reliable and fast operating feature.

The following features shall be considered:

- All Electric (Pollution Free)
- Crash rated (K12)
- ADA Compliant and Pedestrian Friendly
- Operating Speed Equivalent to Hydraulics
- Lower Cost Installation
- Lower Cost Maintenance

8 IBMS TYPICAL REQUIREMENTS FOR RESIDENTIAL BUILDINGS

8.1 GIFT RESIDENTIAL PLAN

GIFT master plan considers residential land use and thereby development of residential facilities of varying typologies to meet the requirements.

The residential land use in the GIFT Master Plan is provided in map below:

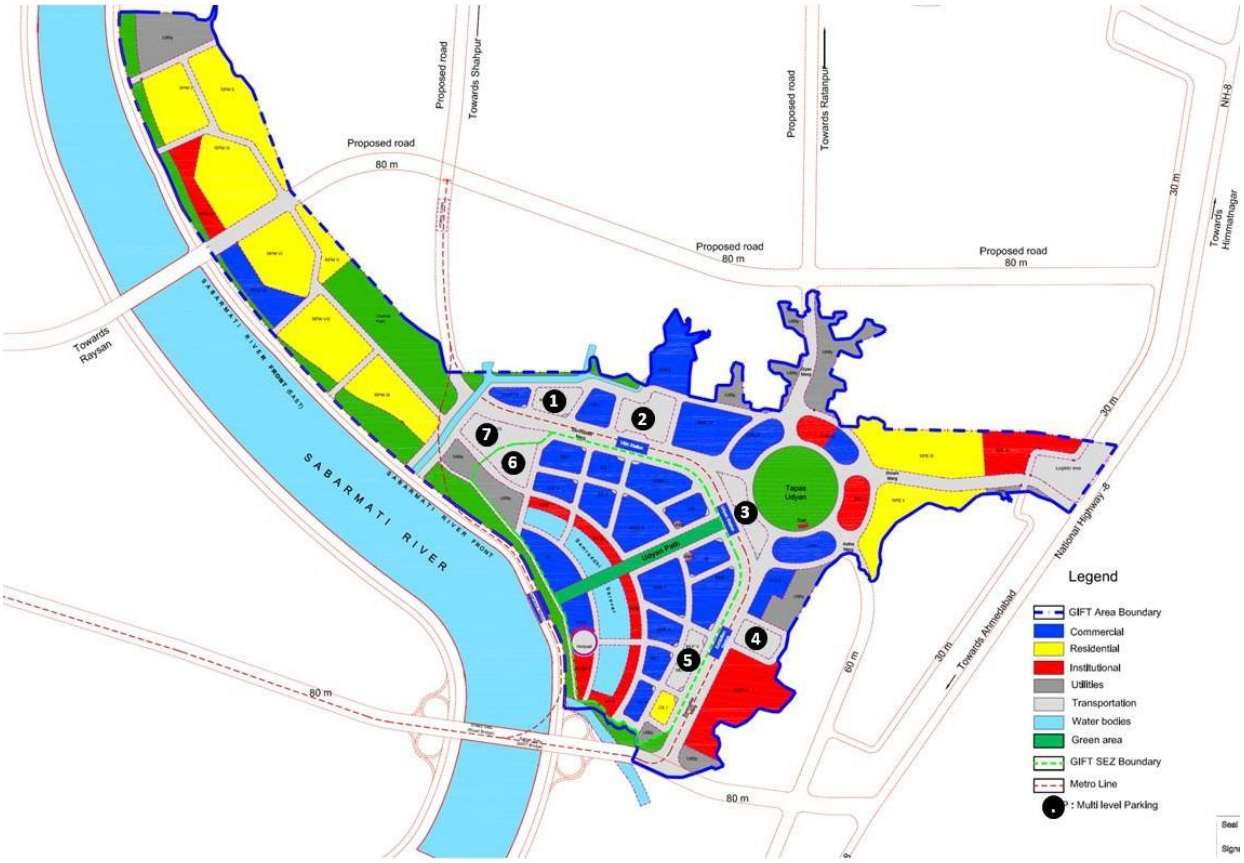


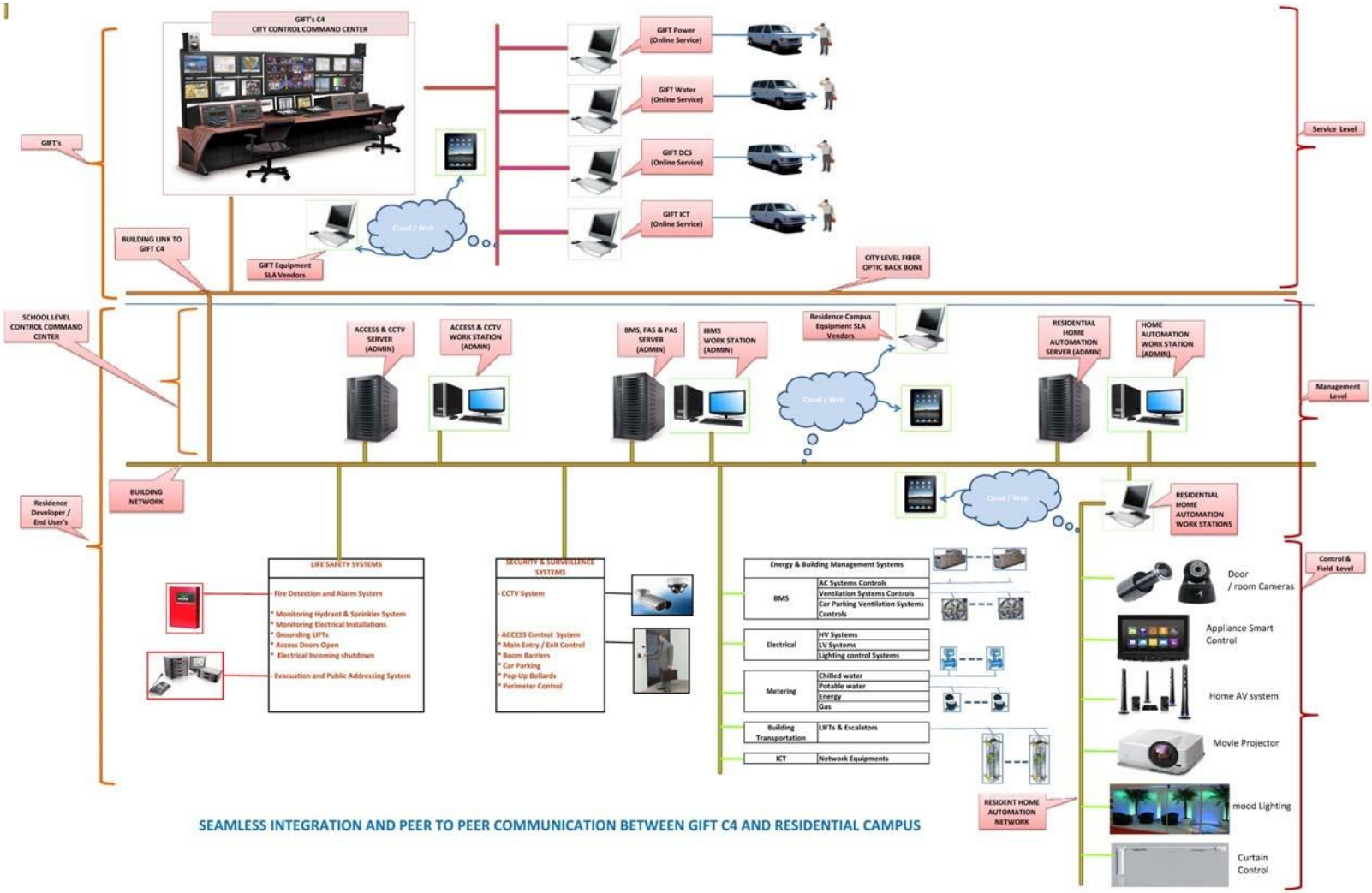
Figure 14: GIFT – Master Plan (Updated Master plan Required)

8.2 TYPICAL IBMS FOR RESIDENTIAL BUILDINGS

Consistent with the GIFT vision, Intelligent Building System Architecture is envisaged for the GIFT residential buildings.

The proposed scheme of GIFT IBMS architecture considering residential campus is provided in figure below:

Figure 15: GIFT IBMS System Architecture with Residential Campus



To achieve the envisioned vision of GIFT, the overall typical IBMS from a Smart City Development approach for residential buildings are specified as being (a) Essential and (b) Suggestive.

8.2.1 Essential IBMS for Residential Buildings

Essential requirements are those that have to be provided by the Developer. For Essential requirements refer Chapter 3 (Building Management Systems), 4 (Life Safety Systems), 5 (Security Systems), 6 (Typical Requirements for Buildings for the respective areas) of this document for the residential building.

1. Suggestive Features for Residential Buildings - **at the discretion of the developer**

8.2.2 The following section specifies the Suggestive Features for Residential Buildings, Individual Residence from a Smart City Development Approach.

1. **Fully Integrated Apartment Controls & Monitoring System –**
   - Fully integrated Apartment Controls & Monitoring System, incorporating distributed control techniques and standard open communication networks. The system shall be implemented as an integrated, open solution, which enables Apartment (Building) Service Center (C2) connectivity through a standard interface.

     The integrated systems include controls, monitoring and connectivity for the whole building (BMS) and for each apartment as follows. Home automation, lighting controls and security systems shall be integrated with BMS as specified herein.

     Apartment Controls & Monitoring System may include the following subsystems:
     - Cooling control
     - Ventilation control
     - Consumption measurements of water, electricity, gas and cooling energy –
     - Lighting control
     - Curtain control
     - Other electrical controls
     - Gas alarms
     - Access control
     - Intruder alarms
     - IP intercom
     - Audiovisual systems

   - All systems in the building shall be integrated with a standard based, generic software platform, which facilitates integration and interoperability of all building systems as described in the System

Architecture. The Platform shall provide standard connectivity to the Apartment Service Center, which shall be capable of providing advanced maintenance and security services.

- **User Interfaces**
  The apartment owner/user shall be able to use the system easily with a graphical browser-based User Interface, using touch screen panel PC's, tablet PC's, IPTV, home computers, laptops, PDA's, and mobile phones. The User Interface shall comply with requirements defined in the System Architecture.

  The web browser-based User Interface shall be generated automatically using the structure of the building defined in the Building Information Model. The user interfaces shall provide easy access to frequently needed functionality, such as lighting controls, temperature set-point modifications, alarms, and configuration of scenes and modes of the residence (e.g., home/away). The same user interface functionality shall be usable through any device with a browser.

- Flat (Residence) systems shall be accessed through the Apartment Service Centre.

  The system shall also enable a client-based User Interface for usage and for central monitoring of systems (Apartment Service Center usage). The User Interface shall allow the following:

  - Alarm monitoring and alarm handling by multiple operators
  - Intruder alarms
  - Fire alarms
  - Alarms from electrical and mechanical systems
  - System maintenance alarms
  - Video monitoring
  - Remote diagnostics, energy optimization and trending
  - Setpoint adjustment
  - Control optimization
  - Peak load management
  - Trending
  - Remote diagnostics of system/devices
  - Preventive maintenance
  - Consumption reports for energy management and billing
  - Logs and reporting
  - User profile and role management
  - Access rights management

  The User Interface shall be implemented as a client application, which includes an automatically adapting to IT connectivity structure of the building, building's parts, individual spaces, different systems, and parts of systems. All systems connected to the Apartment Service Centre can

be accessed through the same graphical User Interface.

The User (GUI) Interface shall show system views, floor plan views, trend view, alarm view and event log view per building and system layer. Any alarm shall be shown in red color in both graphical views and tree structure. Each alarm message shall include shortcut to relevant graphical system and floor plan view.

2. **Residence Mode Customization**

Home Automation systems could be functionally integrated to react to customized modes, as well as occupancy information and other conditions as applicable e.g. While at Home / Away, Child only at Home / Elderly alone at Home, Patient at Home etc. All systems shall react to these mode customizations adjusting automatically into the predefined configuration.

Example: While leaving the residence, the following actions are triggered automatically i.e., at one single button touch, the Doors are locked, burglary alarm system is turned on, ventilation is turned down, set point of cooling is allowed to be high and all lights and speakers are switched off etc.

3. **Controls & Automation**

Indoor Air Quality (IAQ) Controls
Fresh air is supplied centrally for each apartment from Fresh Air Handling Units which shall have control requirements as described in the BMS Section.

FCU Controls
The FCU control node could automatically change the FCU motor speed based on temperature deviation. It shall regulate the cooling valve to meet the desired temperature conditions. FCU control nodes shall communicate on field bus and shall be integrated with BMS system to enable energy optimization and reporting.

Lighting Controls
Lighting could be controlled by Smart Control Nodes connected to field bus. Lighting controls shall be integrated with other automation and security systems. Lighting groups are on/off controlled and dimmed as follows:
- Using local push buttons (on/off, on/off/up/down, lighting scenes)
- On movement detection (occupancy)
- Time schedules
- In connection with modes of the residence
- Using the browser user interface

Consumption Metering (DCS metering as per residential metering policy)

Consumptions of water, electricity and cooling energy could be measured in each apartment. BTU meters shall be connected direct to control network. Water and electricity meters shall be connected to Smart Control Nodes, which are connected to field bus. All consumptions shall be trended into Campus Service Centre's database for generating regular consumption reports. All the metering device used shall be as per local authority recommendation.

Gas Alarms
In case of leakage of gas, the system gives an alarm, which is relayed through Apartment Service Center and to specified mobile phones.

Fire Alarms The scheme should follow the NBC 2016 guidelines
Alarm indications shall be received from the fire alarm system. The alarm shall trigger the following functionality:
- Turn on the local alarm siren
- Shutdown of ventilation in the area concerned
- Show alarm information and personalized evacuation plan in the integrated graphical user interfaces of each apartment
- Forward the alarm to Apartment Service Center for further actions

Access Control
Access control shall be implemented with smart readers, control nodes, electronic keys and electronic locks. The access control system is connected to Apartment Service Centre for full control and reporting and integrated into graphical user interface.

Access control system shall be integrated with cooling and ventilation controls, lighting, and curtain controls as well as with other security systems using the Apartment Service Centre as the integration platform. Access rights can be managed centrally from the Apartment Service Center.

4. IP Intercom

Internal IP calls
It shall be possible to integrate IP Intercom with Apartment Service Centre. Usage can be done both via the integrated User Interface of the Apartment Service Centre and IP phones. The system shall enable IP calls inside the Apartment.

Door Intercom
The door intercom shall convey the door camera picture to the Apartment User Interface in the touch screen(s). Upon doorbell ring the system shall initiate door camera view in the Apartment User Interface. The user can then open two-way audio connection between the door unit and the touch screens and open the door using the touch screen. In case User wants to

alert Apartment service center due to unknown human entry request, then required provision shall be consider in the Apartment Services Centre.

Note- Please refer above section mentioning IBMS guidelines for residential building in conjunction with the revised IBMS guidelines attached herewith this document as Annexure 1.

9 IBMS TYPICAL REQUIREMENTS FOR SCHOOL

9.1 GIFT SCHOOL

GIFT master plan considers development of social infrastructure such as school.

The vision of School in GIFT City shall be – "To develop an international school ambience which will serve as a Next Generation Educational Institute Development in terms of Quality of Education, Pupils Knowledge base and awareness, Infrastructure, Eco and Green Ambience thereby facilitating an Eco-System for all-round societal development."

The location of school in the GIFT Master Plan is provided in map below:

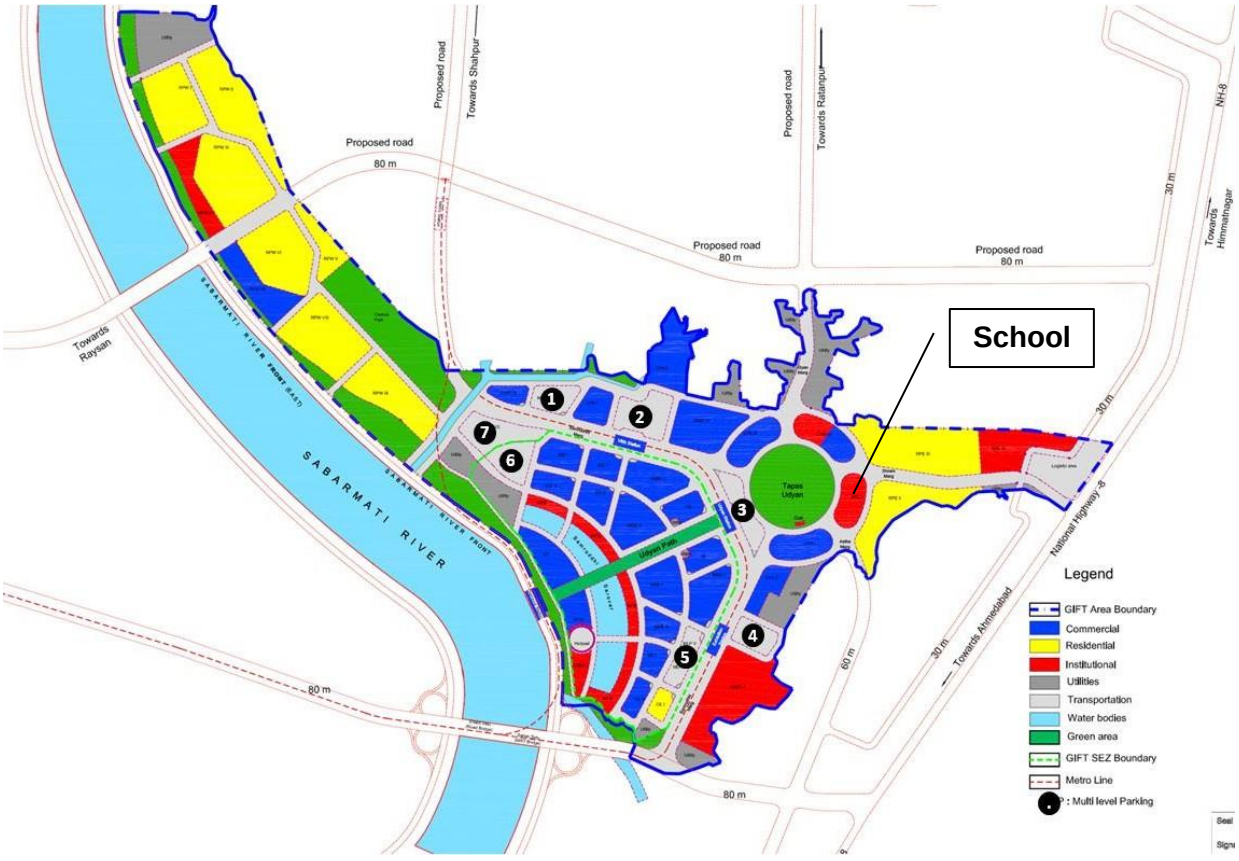


Figure 16: GIFT Master Plan – School Location

9.2 TYPICAL IBMS FOR SCHOOL

To achieve the envisioned vision of GIFT, the objectives for GIFT School are as follows:

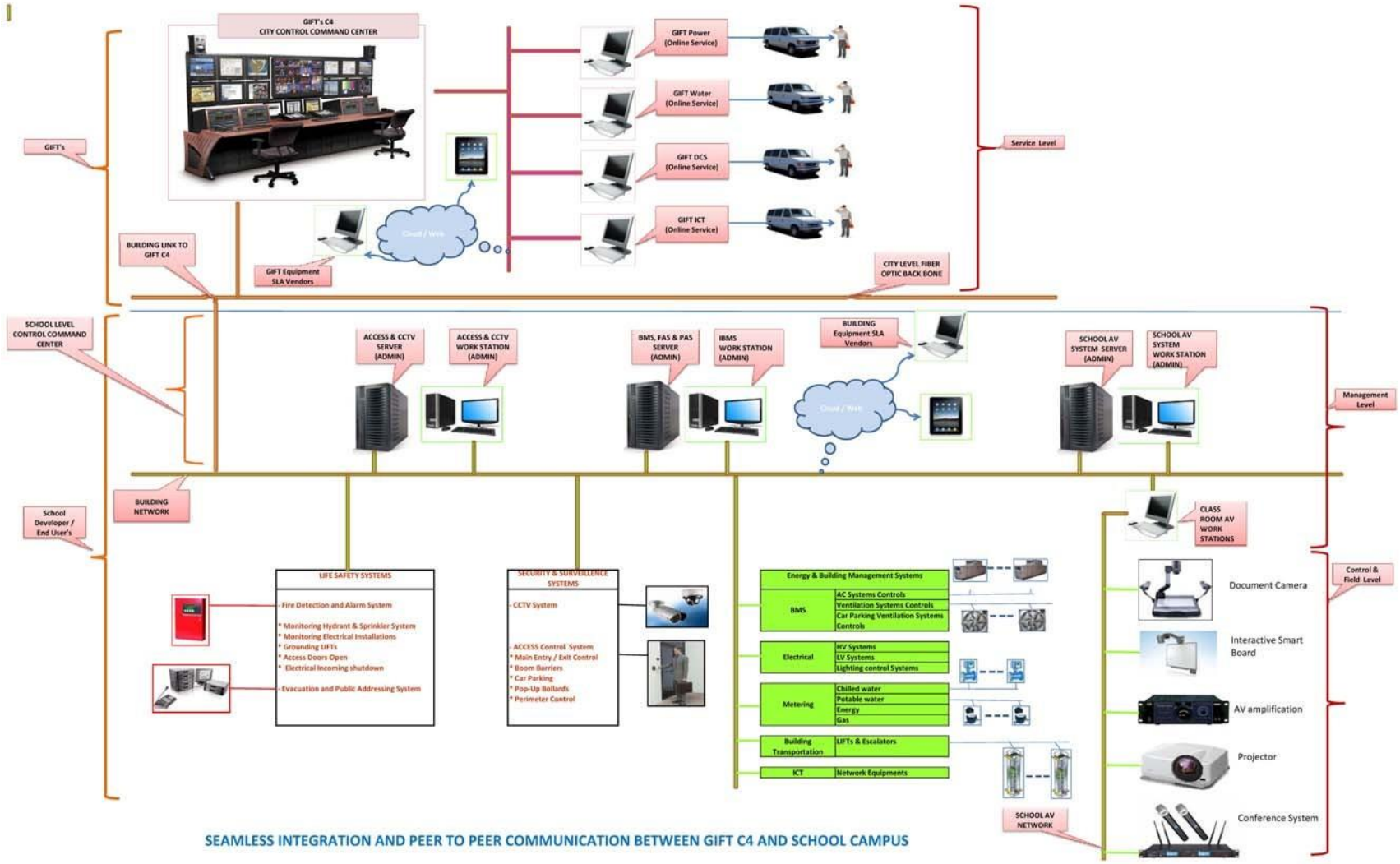
1. Safe and secure school premises and travel
2. Resources management – water, energy, waste
3. Use of emerging ICT for enhanced learning environment, teaching / instruction aids
4. Virtual classrooms and activity spaces
5. Information access by students, teachers, parents etc.
6. Real time interaction with parents / counsellor
7. Enhanced facilities management

Fire and Life safety guidelines are to be implemented as per NBC 2016.

Consistent with the GIFT vision, Intelligent Building System Architecture is envisaged for the school to be developed in GIFT.

The proposed scheme of GIFT IBMS architecture considering residential campus is provided in figure below:

Figure 17: GIFT IBMS System Architecture with School Campus



The overall typical IBMS from a Smart City Development approach for School are specified as being (a) Essential and (b) Suggestive.

9.2.1 Essential IBMS for School

Essential requirements are those that have to be provided by the Developer. For Essential requirements refer Chapter 3 (Building Management Systems), 4 (Life Safety Systems), 5 (Security Systems), 6 (Typical Requirements for Buildings for the respective areas) of this document for the School.

9.2.2 Suggestive Features for School

The following section specifies the suggestive Features for School from a Smart City Development Approach.

1. Transport:

   i. Safe transit between Residence and School

   School Bus Tracker for vehicle tracking system specialized for parents of kids using school bus transport.

   The application sends the SMS alerts to the parents just few minutes before arrival of bus to its designated stop, thus saving the precious time by avoiding long wait for bus. Parents get a sense of security by knowing the current location of bus in case of emergencies like riots, abnormal weather conditions, traffic jams etc.

   School in GIFT may offer this value-added service in showing their concerns for students and their parents. School in GIFT may also indirectly provide security to the students by giving them such facilities.

   The School Bus Tracker is based on the globally known and proven Global Positioning System technology.

   - real time data on stops made by bus and pick up/drop of students at these stops
   - communicate with any driver of bus fleet real time through SMS
   - Parents will receive SMS alerts when the school bus is two stops away for pickup/drop
   - Parents will receive SMS alerts whenever the child gets into the bus/off the bus with location details
   - Parents will get info on school bus's location and expected time of arrival for pick up/drop
   - Get alerts on bus delays
   - Get alerted if any student steps into a wrong bus

- Know the location of any bus in emergencies like rainstorms, riots, traffic snarls etc.
- Monitor every student getting into the school bus
- Detect unscheduled stops made by the bus

ii. Video Surveillance for School Buses

Surveillance cameras can aid the bus driver to keep children in check while navigating the route to or from school. These cameras pointed outside buses can help identify motorists who illegally pass buses or identify driver erratic and dangerous driver behavior. School buses shall have an in-bus CCTV system complete with camera and recording. Use of IP cameras and wireless networking, remote reviewing and instant response could be installed. A bus equipped with a wireless IP video system, operating in an area with a wireless "mesh" network, can immediately transmit footage of violations. Video analytics is a technological advancement that could improve the efficiency of in-bus security camera systems. Using in-camera analytics, could be of valuable assistance to bus drivers.

iii. Eco friendly Bus / CNG fuel / Electric / Solar Powered

2. Utilities

i. School Power from Solar / Wind Energy

Since school operates mostly during the daytime, has great advantage in utilization of energy arrived from Solar harvesting. Energy surveys are a great way to identify the amount of energy used in the school and can highlight areas where changes and improvements can be made.

- Adopt to regular Energy auditing
- Implement "no-cost" (i.e., "switch it off" campaign, adjusting thermostats) and "low-cost" (replacing incandescent bulbs with CFL bulbs) solutions.
- Display the details and results of energy utilization monitoring – graphs and charts
- Visualizing improvement in energy consumption pattern

ii. Water Conservation

School could consider steps in achieving zero discharge schemes for entire water cycle usage. Water is an important resource, and a sufficient supply of clean water is essential to the health of both people and the environment.

- Adopt regular water auditing
- Implement "no-cost" (i.e., ensuring taps are turned off properly, collecting rainwater for plants) and "low-cost" (repairing leaks and drips) solutions.

- Display the details and results of utilization your monitoring – graphs and charts
- Visualizing changes in water consumption pattern

iii. Waste Management

School could consider steps in solid waste management by inculcating program for waste minimization, technology usage for waste management etc.

3. Classroom

Smart classroom could be equipped with advanced educational tools and technology that includes the following:

i. Smart Board Interactive display

ii. Smart document camera

iii. Projection and Audio Systems

iv. large format viewing screens

v. Interactive Response Systems

vi. Video Conferencing

vii. Wi-Fi

viii. laptop consoles

10 IBMS TYPICAL REQUIREMENTS FOR HOTEL

10.1 GIFT HOTEL

GIFT master plan considers development of support infrastructure such as hotels etc. to meet the requirements of business and living.

The vision of Hotel in GIFT City shall be – "To develop an international class hotel making best use of technology to serve the guests with exemplary and personalized user experience"

The location of hotel in the GIFT Master Plan is provided in map below:

10.2 TYPICAL IBMS FOR HOTEL

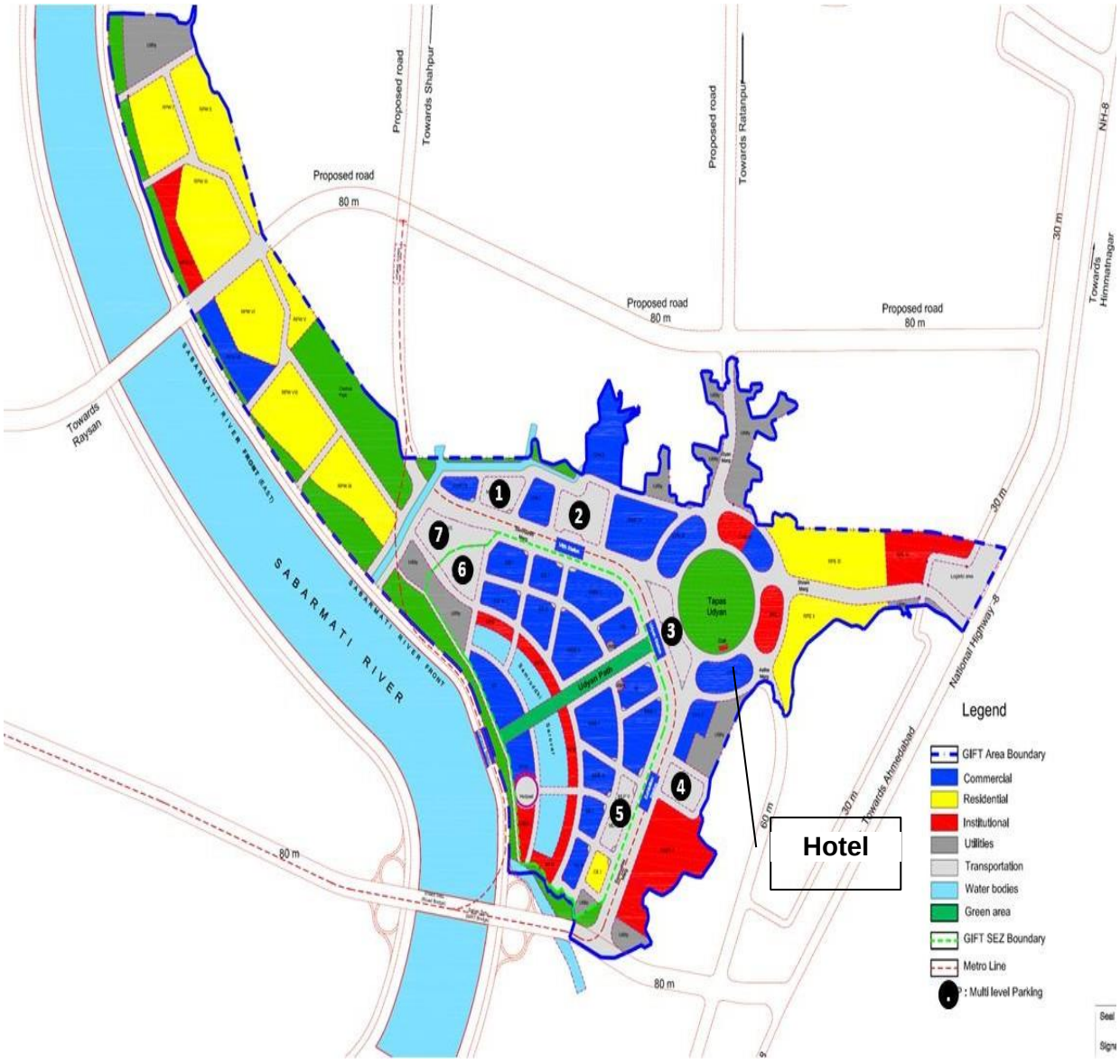


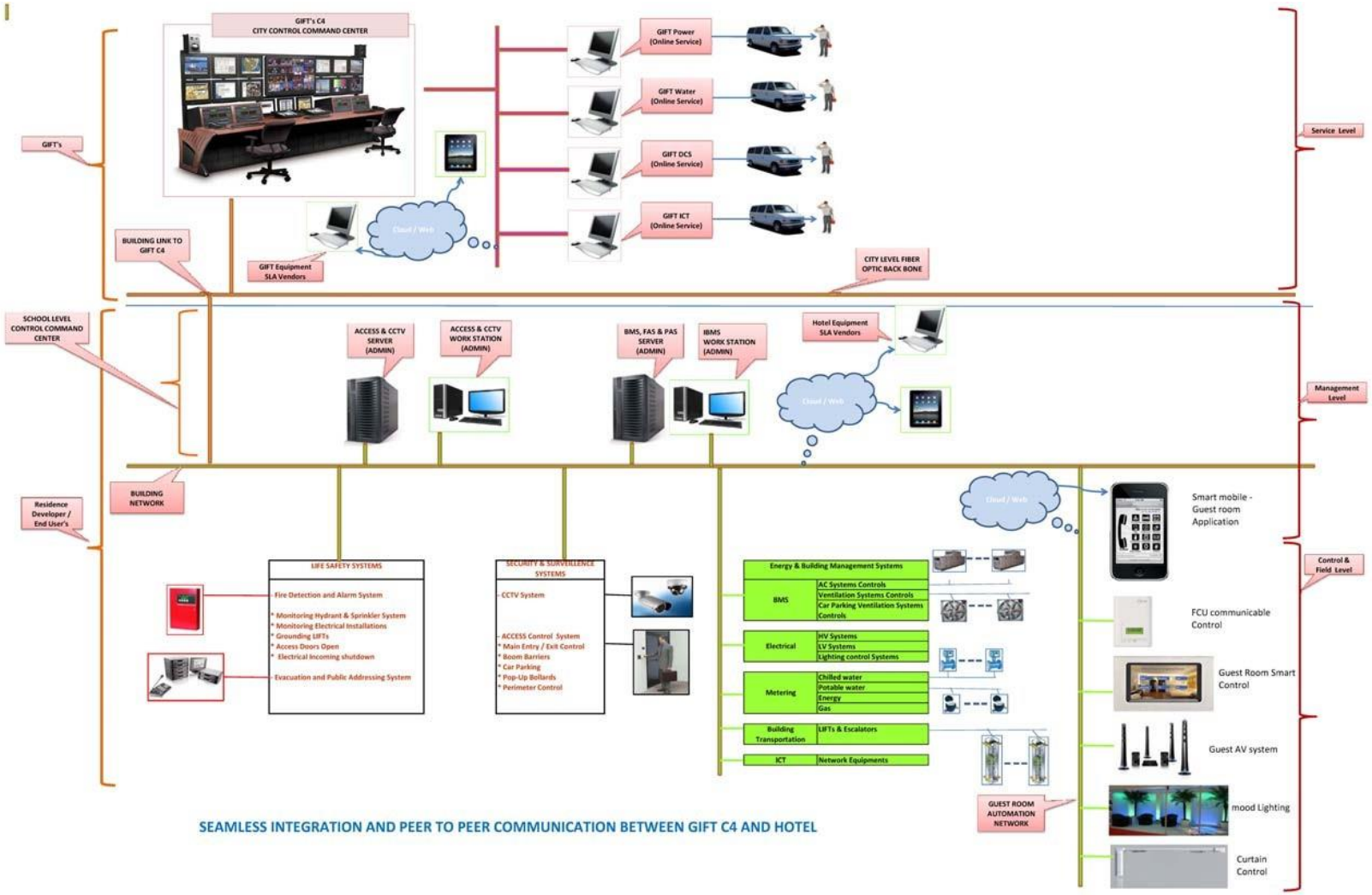
Figure 18: GIFT Master Plan – Hotel Location

1. Safe and secure hotel premises
2. Sustainable Hotel Operations - Resources management: water, energy, waste etc. for
3. Use of emerging ICT for communication systems etc.
4. Value added services to users
5. Enhanced facilities management

Consistent with the GIFT vision, Intelligent Building System Architecture is envisaged for the hotel to be developed in GIFT.

The proposed scheme of GIFT IBMS architecture considering hotel is provided in figure below:

Figure 19: GIFT IBMS System Architecture with Hotel



The overall typical IBMS from a Smart City Development approach for hotel are specified as being (a) Essential and (b) Suggestive.

10.2.1 Essential IBMS for Hotels

Essential requirements are those that have to be provided by the Developer. For Essential requirements refer Chapter 3 (Building Management Systems), 4 (Life Safety Systems), 5 (Security Systems), 6 (Typical Requirements for Buildings for the respective areas) of this document for the Hotel.

10.2.2 Suggestive Features for Hotel

The following section specifies the suggestive Features for Hotel from a Smart City Development Approach.

1. Hotel Management
    i. Facility Management Schedule Application
    ii. Reservation Application
    iii. Room Service Application
    iv. Guest Preference Application
    v. Service Alerts
    vi. Guest Occupancy Management
2. Guest Room Management System
    i. Thermostats
    ii. Suite Controllers
    iii. Lighting Control
    iv. Drapes and Shades Control
    v. Audio – Video Control
    vi. Guest Occupancy Preferences (Do not disturb, housekeeping etc.)
    vii. Door Lock System
3. Best Practices Instructions / Technology provisions that enhance / promote optimized usage of energy / energy conservation for various areas / components of hotel including guest rooms in the following indicative areas:
    i. Appliances:

- Energy efficient appliances
- Low energy lighting and controls
- Efficient heating, cooling and hot water systems
- Insulation and ventilation
- Low embodied energy building
- Renewable energy

ii. Lighting:

During the day, open to the curtains to take advantage of natural light instead of turning on multiple light sources

iii. Air conditioning and heating

Close windows/balcony doors if the air/heating system is on. Alternatively, shut off the air or heat if windows are open. Close the drapes during the day to help keep the room cool.

iv. Towel and Linen Reuse

Option for guests to reuse their towels and linens during their stay rather than having them changed daily.

v. Recycling

Placing recycling bins in the guest rooms and meeting rooms for collection of newspapers, paper, plastics, cans, and glass in it rather than in the garbage bin.

vi. Water conservation

Shut off the tap to avoid leaving the water running during daily chores. Check sink and tub faucets are tightly shut off to avoid water loss from dripping taps.

vii. Transportation

Options other than cabs or car rentals. Information on local transit, bike rentals, shuttle services, carpooling etc.

viii. Others

1. Purchasing policy, disposal and consumable good policy, hotel management policy

2. Green audits (for areas mainly pertaining to – energy conservation, water conservation, solid waste management, indoor air quality, greenhouse gas, landscape, etc.)

ix. Green Meeting Program

1. Events, from small meetings to large scale conventions, consume energy, produce waste, and create harmful emissions. Hotels and Meeting Planners alike are increasingly becoming aware of the environmental impacts and as such hosting a green meeting is becoming more and more common.

2. Green meeting or event incorporates environmental initiatives to minimize its negative impact on the environment, from energy and water consumption, travel & transportation, food & beverage, handouts, garbage and more.

3. The areas pertain to the following:

    - Core Areas (Carbon, Energy, Waste, Water, Air Quality)
    - Communication (Information, Training)
    - Activities (Purchasing, Auditing, Community)
    - People (Health)
    - Exhibitions
    - Audio/Visual

11 IBMS TYPICAL REQUIREMENTS FOR EXHIBITION CENTRE

11.1 EXHIBITION CENTRE AT GIFT

GIFT master plan considers development of support infrastructure such as exhibition center etc. to meet the requirements of business.

The vision of Exhibition Centre in GIFT City shall be – "To develop an international class exhibition center making best use of technology to serve the users more effectively"

The location of exhibition center in the GIFT Master Plan is provided in map below:

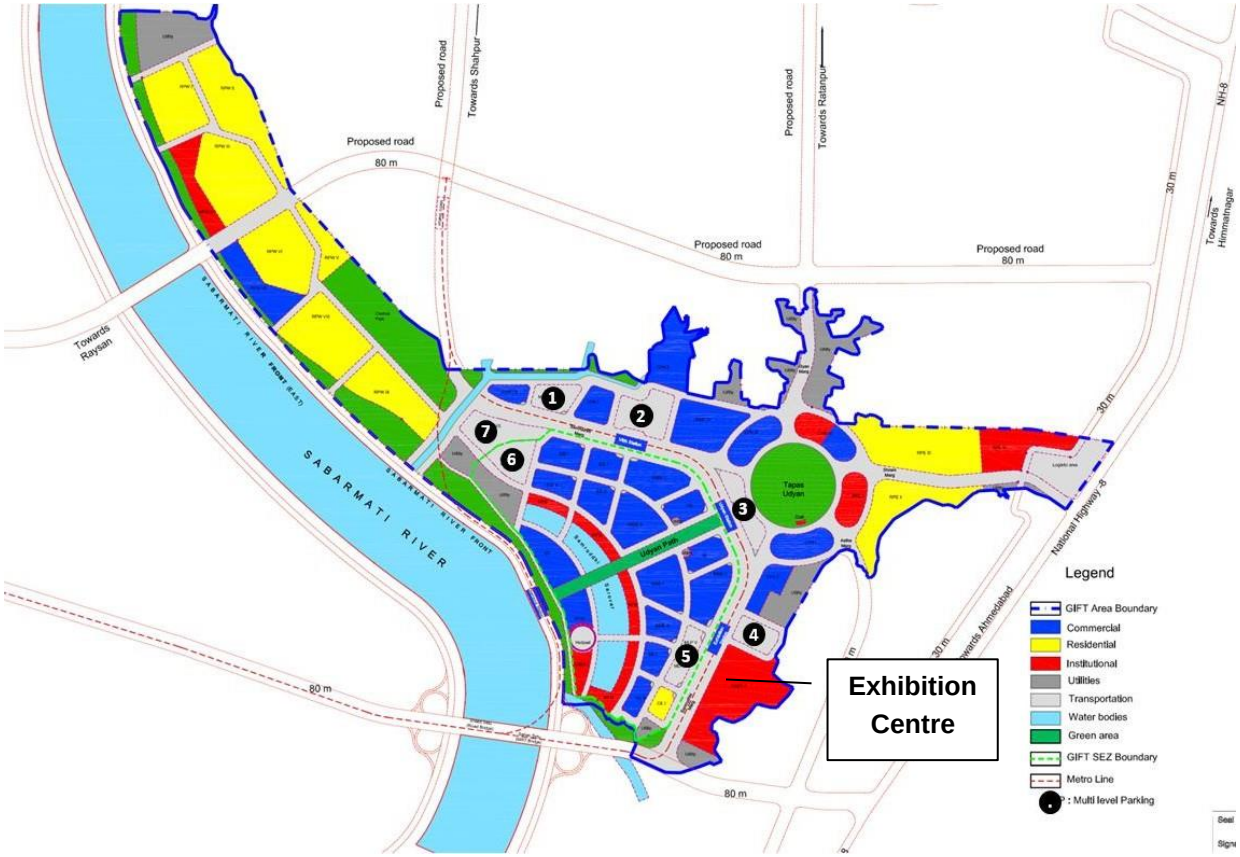


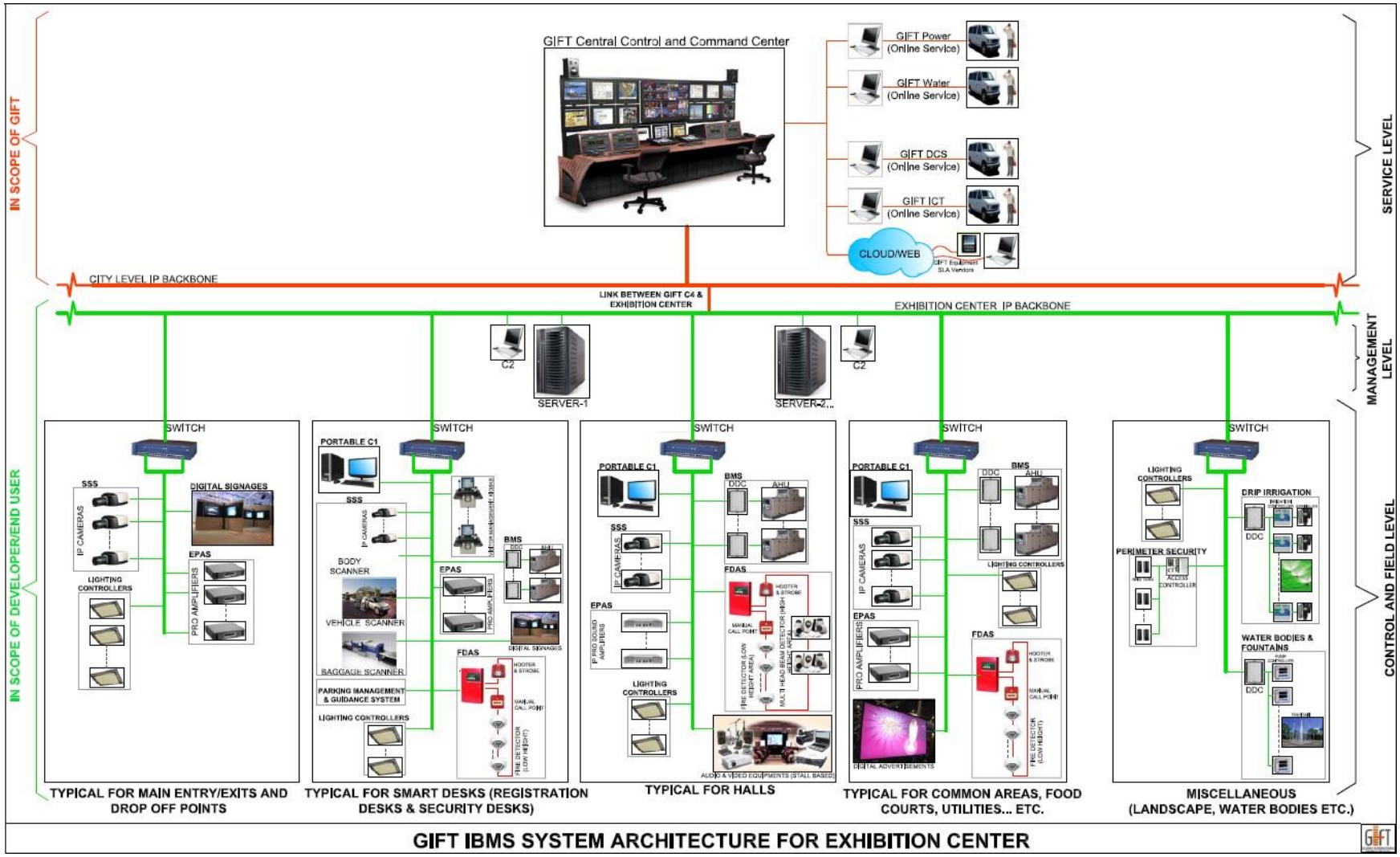
Figure 20: GIFT Master Plan – Exhibition Centre Location

11.2 TYPICAL IBMS FOR EXHIBITION CENTRE

Consistent with the GIFT vision, Intelligent Building System Architecture is envisaged for the exhibition center to be developed in GIFT.

The proposed scheme of GIFT IBMS architecture considering exhibition center is provided in figure below:

Figure 21: GIFT IBMS System Architecture with Exhibition Centre



Installation and maintenance of IBMS component within the block will fall in purview of the developer inclusive of open areas, common areas like food courts, registration counters etc.

Due to the nature of the space and its application the functional location of IBMS Sub-systems controls differs from the building requirement. The following table below explains the functional location of various IBMS sub systems at individual office/hall level (C1, U1) and block level (C2, U2).

Table 17: Functional Location of IBMS Sub-system controls – Exhibition Centre

	IBMS Sub Systems	C1, U1 Functional Location	C2, U2 Functional Location
a	Building Management System (BMS) - Personal Computer / Server	Portable workstations (C1) for each hall, office, registration areas and common areas connected to predefined IBMS network port.	Part of Block Facility Manager's office / cabin; Dedicated space with A/c, controlled access, furniture.
b	Fire detection and Alarm system (FACP)	Online repeater panel at portable workstation (C1) for each hall, office, registration areas and common areas.	FACP Part of Block Facility Manager's office / cabin; Dedicated space with A/c, controlled access, furniture.
			Online repeater panel in Block Security Officer's office / cabin.
c	Fire detection and Alarm system (GUI Station - Computer / Server)	Portable workstations (C1) for each hall, office, registration areas and common areas connected to predefined IBMS network port.	FAS GUI Station (personal computer / Server) - Part of Block Facility Manager's office / cabin; Dedicated space with A/c, controlled access, furniture.
d	EPA network controller and GUI station - Computer / Server	Portable workstations (C1) for each hall, office, registration areas and common areas connected to predefined IBMS network port.	Part of Block Facility Manager's office / cabin; call console in Security officer's office / cabin; Dedicated space with A/c, controlled access, furniture.
e	CCTV GUI Station (computer / Server)	Portable workstations (C1) for each hall, office, registration areas and common areas connected to predefined IBMS network port.	Part of Block Facility Manager's office / cabin; Monitoring console in Security officer's office / cabin; Dedicated space with A/c, controlled access, furniture.

	IBMS Sub Systems	C1, U1 Functional Location	C2, U2 Functional Location
f	CCTV head end equipment (NVR / computer / Server)	NA	Part of Block Facility Manager's office / cabin; Dedicated space with A/c, controlled access, furniture.
g	ACS GUI Station (computer / Server)	Portable workstations (C1) for each hall, office, registration areas and common areas connected to predefined IBMS network port. Visitor management system at registration counter.	Part of Block Facility Manager's office / cabin; Monitoring console in Security officer's office / cabin; Dedicated space with A/c, controlled access, furniture.

Due to the nature of the space and its application the GIFT IBMS Interface for Exhibition Centre is provided in the following table.

Table 18: GIFT IBMS Interface – Exhibition Centre

Level	Location	IBMS	Interface
Occupant Level	Organizer/Exhibitor (Portable C1)		**Stall Interface** between the Organizer/Exhibitor and portable C1 for energy consumption and audio-visual requirements.
Block Level	Developer (C2)	Minimum IBMS requirements would be specified by GIFT for Block Level (C2) that shall be provided by the developer	**Developer Interface** between the Organizer/Exhibitor C1/U1; Block level C2/ U2 and GIFT C4.
GIFT Area Level	GIFT - City Control Command Center (C4)	IBMS specified for GIFT's interfacing with exhibition block (C2).	**GIFT Interface** between the block C2/U2 with C4 level: It is the responsibility of the developer to ensure that his system is compatible for interfacing with GIFT's C4.

			Developer shall plan and provide adequate database support to hold transactions between his system and GIFT's C4. Developer shall consider redundant provision wherever applicable and called for by GIFT.

The overall typical IBMS from a Smart City Development approach for Exhibition Centre are specified as being (a) Essential and (b) Suggestive.

11.2.1 Essential IBMS for Exhibition Centre

Essential requirements are those that have to be provided by the Developer. For Essential requirements refer Chapter 3 (Building Management Systems), 4 (Life Safety Systems), 5 (Security Systems), 6 (Typical Requirements for Buildings, Campus for the respective areas) of this document for the exhibition center.

11.2.2 Suggestive Features for Exhibition Centre

The following section specifies the suggestive Features for exhibition center from a Smart City Development Approach.

Smart Desks:

From main Entry/Exit and drop off point the visitors shall be guided to the Smart Desks which will have Registration Desks and Security Desks. The Registration Desks shall facilitate efficient Visitor Management System. Security Desks shall provide all necessary access control systems, security and surveillance systems, life safety systems etc. for all halls. Smart Desks shall be built, operated and managed by the developer. Following table provides detailed IBMS requirements for Smart Desks.

Table 19: Smart Desks

Scope	Equipment	Description of function	Instrument	Interface
Registration/Help Desk Kiosk	Interactive kiosk display unit	Visitor registration Visitor assistance	To generate visitor's database	Up- link to C2

12 Green Performance Suggestive Features of IBMS Sub- Systems

GIFT envisages to develop an environment friendly area which will make efficient use of all resources and will also guarantee user's safety and building's safety. This concept needs to be materialized at all levels of planning, design, development, operation, and maintenance.

IBMS is a tool to achieve aforesaid aim and its use will also optimize the operational cost of buildings. IBMS shall enable to create radically improved energy performance and increased water efficiency, according to requirements of LEED and other Green Building standard and initiatives. Following sections will therefore provide guidelines for green performance features of IBMS sub-systems related to energy conservation and water efficiency.

System integration shall also allow for efficient system maintenance and full-scale service provisioning with radically lower cost and better-quality services. Integration shall facilitate undisturbed conditions in the building and sustainable development through minimized energy consumption, first-class security, and significantly lower life cycle costs. Facility management team needs to monitor and care for a building by assessing its vital systems and the level of their performances, and then take effective steps for improvements. Hence special sections in the chapter will guide about system maintenance and upkeep.

As mentioned earlier that energy and water are prime fields of environmental concern and are intended to be radically utilized in GIFT by integration of building systems, therefore the following sections will deal with related IBMS sub-systems their maintenance and upkeep.

12.1 ENERGY CONSERVATION

HVAC and lighting are major sources of energy consumption in commercial buildings. With special emphasis upon above two sub-systems of IBMS this chapter will discuss the minimum green performance features which shall be incorporated in GIFT buildings though the developer shall not limit the scope and shall explore and incorporate other green performance features as well.

12.1.1 HVAC at the discretion of developer

1. Scheduled and automatic shutdown operation:

a. All the HVAC units shall be equipped with controls that can start and stop the unit under different time schedules for seven days per week, holidays, special occasion shall be capable of retaining programming and time setting during

loss of power for a period of at least 24 hours, and shall include an accessible manual override, that allows temporary operation of the system.

b. An occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.

c. An interlock to a security system that shuts the system off when the security system is activated or identified that no one is present in the premises.

2. Variable air volume (Induction / Normal type) system:

a. System shall control operation of VAV units independent of pressure and absolutely based on CFM and space temperature.

b. The AHU fan shall be driven by an electrical variable-speed drive with BACnet connectivity to IBMS. The AHU discharge CFM shall be monitored for precise control of the entire VAV unit's network.

c. The Static pressure sensors installed in the field ducts shall result operation of the fan motor to a minimum demand of design air volume when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data.

3. Energy recovery:

a. Exhaust air energy recovery: Individual fan systems that have both a design supply air capacity and have a minimum outdoor air supply shall have an energy recovery system with possible maximum % recovery effectiveness. Energy recovery effectiveness shall mean a change in the enthalpy of the outdoor air supply equal to % of the difference between the outdoor air and return air at design conditions. Provision shall be made to bypass or control the heat recovery system to permit air economizer operation.

4. Hydronic variable flow systems:

a. HVAC pumping system shall include pressure independent control valve for AHUs, CSUs, FCUs, FAHs designed to modulate flow as a function of load variation.

b. The circulation pumps shall be designed for variable fluid flow and shall be capable of reducing circulation pump flow rates to a minimum design flow rate.

c. Individual pumps serving variable flow systems shall have devices such as variable speed drive, pump controller with BACnet connectivity to IBMS.

d. These pump controls shall maintain desired flow ensuring required differential pressure. Differential pressure shall be measured at or near the

most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.

5. Chilled water temperature reset controls:

a. Chilled water systems supplying chilled water to comfort conditioning systems shall include controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outdoor air temperature.

6. System Balancing:

a. **General:** All HVAC systems shall be balanced in accordance with generally accepted engineering standards. A written balance report shall be provided for acceptance of the system by designated representative of the developer.

b. **Air System Balancing:** Air systems shall be balanced in a manner to first minimize throttling losses. Then, for fans with fan system, fan speed shall be adjusted to meet design flow conditions.

c. **Hydronic System Balancing:** Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses; then the pump impeller shall be trimmed, or pump speed shall be adjusted to meet design flow conditions.

7. Ventilation System Controls: - Essential

a. **Stair and Shaft Vents:** Stair and elevator shaft vents shall be equipped with motorized dampers that are capable of being automatically closed during normal building operation and are interlocked to open as required by fire and smoke detection systems.

b. **Gravity Hoods, Vents, and Ventilators:** All outdoor air supply and exhaust hoods, vents, and ventilators shall be equipped with motorized dampers that will automatically shut when the spaces served are not in use.

c. **Shutoff Damper Controls:** Both outdoor air supply and exhaust systems shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use. Ventilation outdoor air dampers shall be capable of automatically shutting off during preoccupancy building warm-up, cool down, and setback, except when ventilation reduces energy costs (e.g., night purge) or when ventilation must be supplied to meet standard requirements.

d. **Ventilation Fan Controls:** Fans with motors shall have automatic controls that are capable of shutting off fans when not required.

12.1.2 Lighting Control

a. **Automatic Lighting Shutoff:** Interior lighting in halls and other buildings shall be controlled with an automatic control device to shut off lighting in all spaces. This automatic control device shall function on either:

   i. a scheduled basis using a time-of-day operated control device that turns lighting off at specific programmed times
   ii. an occupant sensor that shall turn lighting off within 10 minutes of an occupant leaving a space
   iii. a signal from another control or alarm system that indicates the area is unoccupied.

b. **Exterior Lighting Control:** Lighting for all exterior applications shall have automatic controls capable of turning off exterior lighting when sufficient daylight is available or when the lighting is not required during nighttime hours.

c. **Additional Control:**

   iv. Display/Accent Lighting—display or accent lighting shall have a separate control device.
   v. Case Lighting—lighting in cases used for display purposes shall have a separate control device.
   vi. Task Lighting—supplemental task lighting, including permanently installed under shelf or under cabinet lighting, shall have a control device integral to the luminaries or be controlled by a wall-mounted control device provided the control device is readily accessible and located so that the occupant can see the controlled lighting.
   vii. Nonvisual Lighting—lighting for non-visual applications, such as plant growth and food warming, shall have a separate control device.
   viii. Demonstration Lighting—lighting equipment that is for sale or for demonstrations in lighting education shall have a separate control device.

d. **Exit Signs:** Internally illuminated exit signs shall not exceed 5 watts per face.

Lighting Level Recommendations

As mentioned above, different tasks and areas require differing light levels. It is better to provide high-quality light where needed, rather than high levels of light in all areas needlessly. Therefore, the following tables show necessary lighting densities in different areas of buildings: (Reference)

Table 20: Lighting Power Densities Using the Building Area Method

Building Area Type	(W/m^2)
Convention Center	13
Dining: Bar Lounge/Leisure	14

Dining: Cafeteria/Fast Food	15
Dining: Family	17
Motion Picture Theater	13
Office	11
Parking Garage	3
Performing Arts Theater	17
Police/Fire Station	11
Retail	16
Transportation	11
Warehouse	9

Table 21: Lighting Power Densities Using the Space-by-Space Method (References)

Common Space Types LPD (W/m2)		Building Specific Space Types (Continued) LPD (W/m2)	
Office-enclosed	12	Fire Station Engine room	9
Office-open plan	12	Convention Center - Exhibit Space	14
Conference/ Meeting/ Multipurpose	14	For Motion Picture Theatre	12
Lobby	14	Audience/ Seating Area	10
For Performing Arts Theater	36	For Transportation	5
Lounge/Recreation	13	Atrium-first three floors	6
Dining area	10	Atrium-each additional floor	2
For Bar Lounge/Leisure Dining	15	General Exhibition	11
Food Preparation	13	Corridor/Transition	5
Restrooms	10	Stairs - active	6
		Active Storage	9

12.1.3 Energy rated appliances

Along with HVAC and lighting there are lots many other appliances which consume considerable amount of energy in a building. Therefore, the developer and end user shall use higher rated appliances which will consume relatively less energy. Most of these products are superior in quality and performance to unqualified models. While some energy star appliances may cost more upfront, they will all cost less to operate over time with savings on utility bills.

12.2 WATER EFFICIENCY

12.2.1 Water Efficient Products

Water is a valuable resource and therefore it is necessary to regulate its wastage. Water consumption is also related to energy use, as less water in the wastewater

system reduces the energy required by treatment plants to treat and supply the water. In addition to inspecting regularly for water leaks and responding immediately when receiving reports from residents, the developer can achieve water savings by ensuring water fixtures are installed with the appropriate flow-control devices.

Responsible use of fresh water means ensuring that all water-consuming fixtures in public areas are operating properly, with no leaks or drips, constantly running toilet tanks, or "ghost" flushes from automatic sensor-based fixtures.

For conservation of water and energy required for its supply and treatment, it is necessary to regulate wastage of water. Following are few guidelines that shall be followed by the developer in order to regulate wastage of water:

- Install flow reduction devices and automatic controls that meet standards of less than 1.5 gallons per minute (gpm) on faucets and less than 2.5 gpm on showerheads.
- Install high-efficiency toilets that use less than 1.5 gallons per flush (gpf) such as those with dual-flush mechanisms or pressure-assist models.
- Choose toilets that rate high in testing programs for waste removal thresholds.
- Install high efficiency urinals that are with less than 0.5 gpf or water free.

Apart from above mentioned strategies of green performance of buildings the developer shall explore and incorporate other techniques as suggested by LEED, USGBC etc.

12.3 BUILDING SYSTEMS COMMISSIONING

Intent: To verify and ensure that fundamental building elements and systems are designed, installed, and calibrated to operate as intended.

Requirement: To implement or to have a contract in place to implement the following fundamental best practice commissioning procedures:

- Engage a commissioning team that does not include individuals directly responsible for project design or construction management
- Review design intent and basis of design documentation
- Incorporate commissioning requirements into the construction documents
- Develop and utilize a commissioning plan
- Verify installation, functional performance, training and operation and maintenance documentation.
- Complete a commissioning report

Potential Technologies & Strategies

- Engage a commissioning authority and adopt a commissioning plan.

Include commissioning requirements in bid documents and task the commissioning agent to produce a commissioning report once commissioning activities are completed.

12.4 OPERATIONS AND MAINTENANCE

Green maintenance is an approach to the maintenance and operation of buildings with the aim of increasing the life of products, reducing exposure to chemical and toxic substances, and reducing the cost to operate equipment.

Green maintenance meets three fundamental objectives:

- Increases energy efficiency
- Conserves natural resources
- Improves indoor air quality

Green maintenance practices make the buildings last longer, cost less to operate, and feel more comfortable.

Some of the areas where green maintenance can be looked upon from energy management perspectives are provided in the further sections. However, the scope is not limited, and the Developers shall explore the areas to gain the best advantage from green maintenance considerations.

12.4.1 HVAC Systems

Field studies of commercial heating, ventilating, and air-conditioning (HVAC) equipment revealed that "common" problems with equipment and controls including leaky ducts and dirty air filters can increase a building's energy consumption about 15 to 30 percent and affect indoor air quality and occupant satisfaction. Often, these problems can be eliminated by better maintenance and inspection practices. IBMS shall support the need of green maintenance practices.

ASHRAE Standard "Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems" provides guidance regarding inspection and maintenance practices for HVAC systems.

12.4.2 Lighting

It is necessary to follow energy conserving operations and maintenance practices for lighting which have a significant effect on a building's energy use and the productivity of its occupants.

Apart from incorporating IBMS elements for lighting, as mentioned in earlier chapters, following maintenance practices will ensure energy conservation during operation phase of buildings:

- Lighting Audits

  Lighting audits can be performed by energy service companies, architecture and engineering firms, or utilities. They can also be done by qualified internal staff or maintenance engineers. The auditor should:

  - Conduct a preliminary energy audit of lighting usage in all the buildings, as well as the outdoor spaces (at a minimum, focus on the public spaces). The audit should note the number and type of fixtures in use, their light sources (and lamp type/model/wattage), the light levels in various areas, how long the fixtures are on per day (and variations during weekends), and what controls are in use. A good lighting auditor can also note the placement and light distribution of fixtures and suggest changes if needed.

  - Use the audit as a baseline, if one is not available, to monitor building energy use. An audit also helps to identify the types and quantity of devices not connected to any control systems, and whether or not they should be.

  - Use the results from the audit to assess the savings potential of various efficiency measures so that they can be properly considered before implementation.

- Develop a lighting system maintenance policy and review it with the maintenance team to ensure they use the correct lamps and ballasts and that they clean and maintain lighting system and sensor components properly.

- O&M team should consider developing and implementing a maintenance action plan that includes fixture cleaning, lamp replacement and other measures such as testing and fine-tuning sensors to achieve the full range of benefits generated by well-maintained lighting.

- Tracking and periodic reviews (monthly or quarterly) of lighting and building energy performance shall be done so as to provide a feedback loop and an early warning system. The tracking complements routine O&M practices by creating a baseline for building energy use to indicate whether new or changes in routine affect energy use and user comfort. Tracking shall also identify unusual changes in energy use pattern for further investigation.

12.5 MEASUREMENT & VERIFICATION

Intent: Provide for the ongoing accountability of building energy consumption performance over time.

Requirements: Develop and implement a Measurement & Verification (M&V) Plan consistent with Calibrated Simulation (Savings Estimation Method), or Energy Conservation Measure Isolation, as advised in the International Performance

Measurement & Verification Protocol (IPMVP). The M&V period shall cover a period of no less than one year of post construction occupancy.

Potential Technologies & Strategies

Develop an M&V Plan to evaluate building and / or energy system performance. Characterize the building and / or energy systems through energy simulation or engineering analysis. Install the necessary metering equipment to measure energy use. Track performance by comparing predicted performance to actual performance, broken down by component or system as appropriate. Evaluate energy efficiency by comparing actual performance to baseline performance.

While the IPMVP describes specific actions for verifying savings associated with energy conservation measures (ECMs) and strategies, this LEED credit expands upon typical IPMVP M&V objectives. M&V activities should not necessarily be confined to energy systems where ECMs or energy conservation strategies have been implemented. The IPMVP provides guidance on M&V strategies and their appropriate applications for various situations. These strategies should be used in conjunction with monitoring and trend logging of significant energy systems to provide for the ongoing accountability of building energy performance.