

# Considerations on design in the life and safety of an infrastructure project.

ARFF International Conference 2024



# Considerations of Life & Safety in Infrastructure Design

1. Terminal-2 Salient Features.
2. Block wall and Construction Drawings and Considerations.
3. Egress Staircase Drawings and Considerations.
4. Egress Staircase Markings.
5. Fire Alarm System Integration
6. PFAS and its Implications
7. How the design features support ARFF and its response

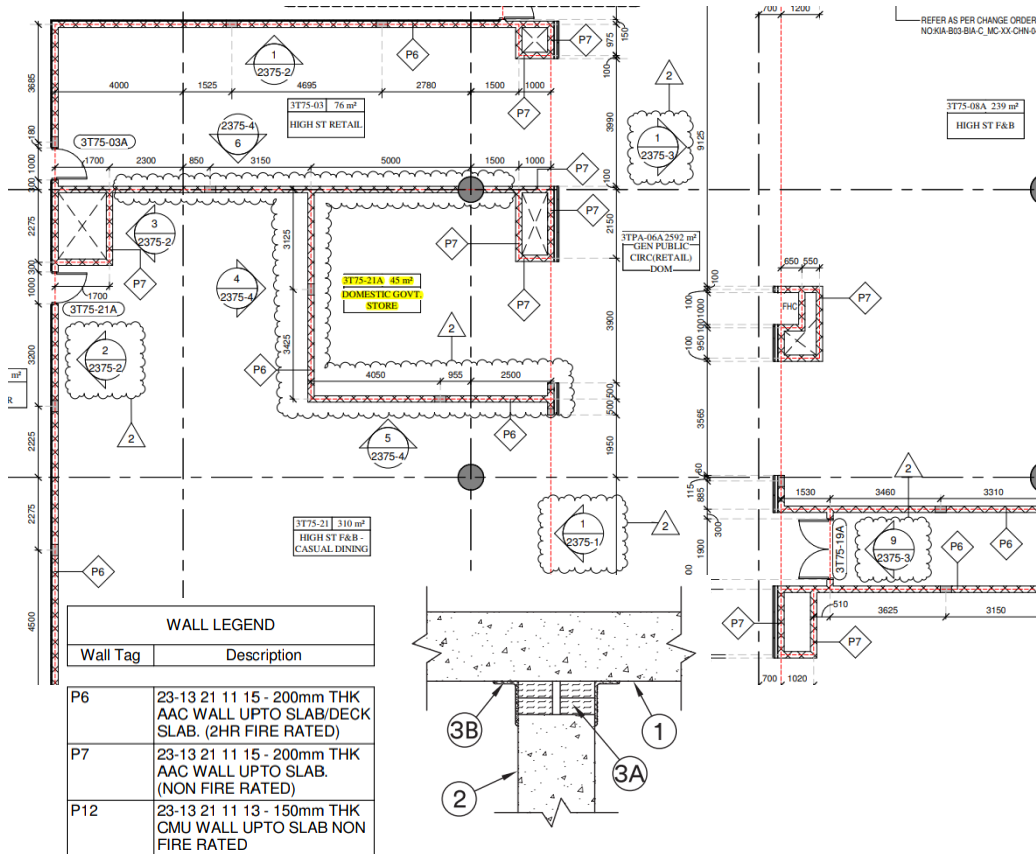




# Terminal-2 Salient Features.

- **Structure –**
  - Total building area – 255,000 SQM for Phase – 1
  - Total number of Levels – 5
- **HVAC System -**
  - 7200 Ton Capacity Chiller Plant – 4 chillers of 1800 TR each
  - 12 cell FRP Cooling tower / 15 Pumps ( 75 to 250 HP )
  - 2,00,000 Sq m of ducting / 25 KMs of piping network
  - 290 nos. Air Handling Units / 05 Precision AHUs
  - 230 Fans ( 65 Smoke extract fans)
  - State of the art CPO (Chiller plant) Optimizer to operate, monitor & control HVAC system
- **Electrical System –**
  - HT Cable : 12 KM
  - LT Cable: 250 KM
  - Wiring: 3000 KM
  - Cable tray / raceway: 50 KM
- **ICT System –**
  - Cable tray / raceway: 40 KM
  - CAT 6A Cable: 3000 KM
- **FPS and FAS System –**
  - Installation of Fire Fighting Pipe - 140 kms
  - Laying of Fire Alarm Cables - 175Km
  - Fire Systematic Sprinklers - 36,000 nos
  - Addressable Detectors - 12,000 nos
  - Fire Pumps (Electric & Jockey) - 4 nos
  - Fire Extinguishers - 3000 nos.
  - Fire Hydrants (Internal & External) - 291 nos.
  - Gas Suppression System - 46 Rooms
  - Fire Alarm Panels - 30 nos

# Block wall and Construction Drawings and Considerations.

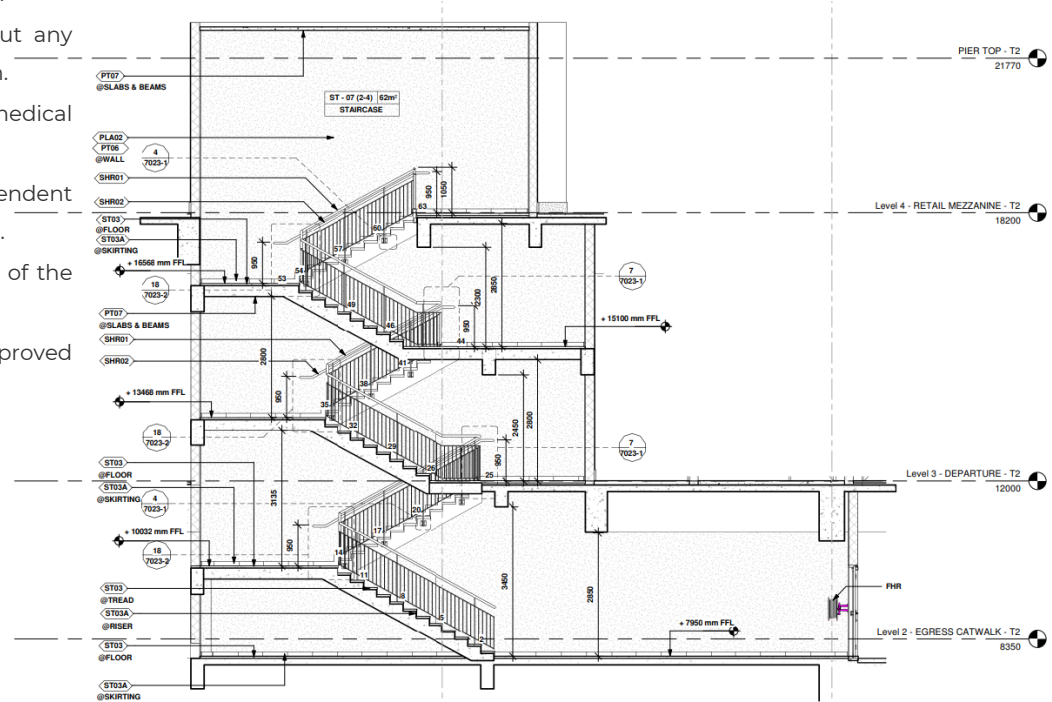
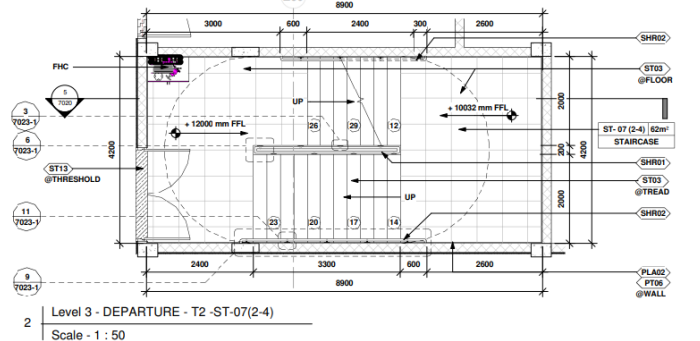


- Fire ratings of walls to be clearly specified in all construction drawings and specifications.
- Proper closure of all fire seals to follow UL codes.
- All MEP (Electrical, PHE, HVAC) needs to comply to all wall ratings so that proper closure materials complying to fire standards as ensured.
- All drawings to be certified by a registered architect and approved by the local fire authority before construction.
- Random site audits to be conducted by ARFF teams to ensure compliance as a third-party check.

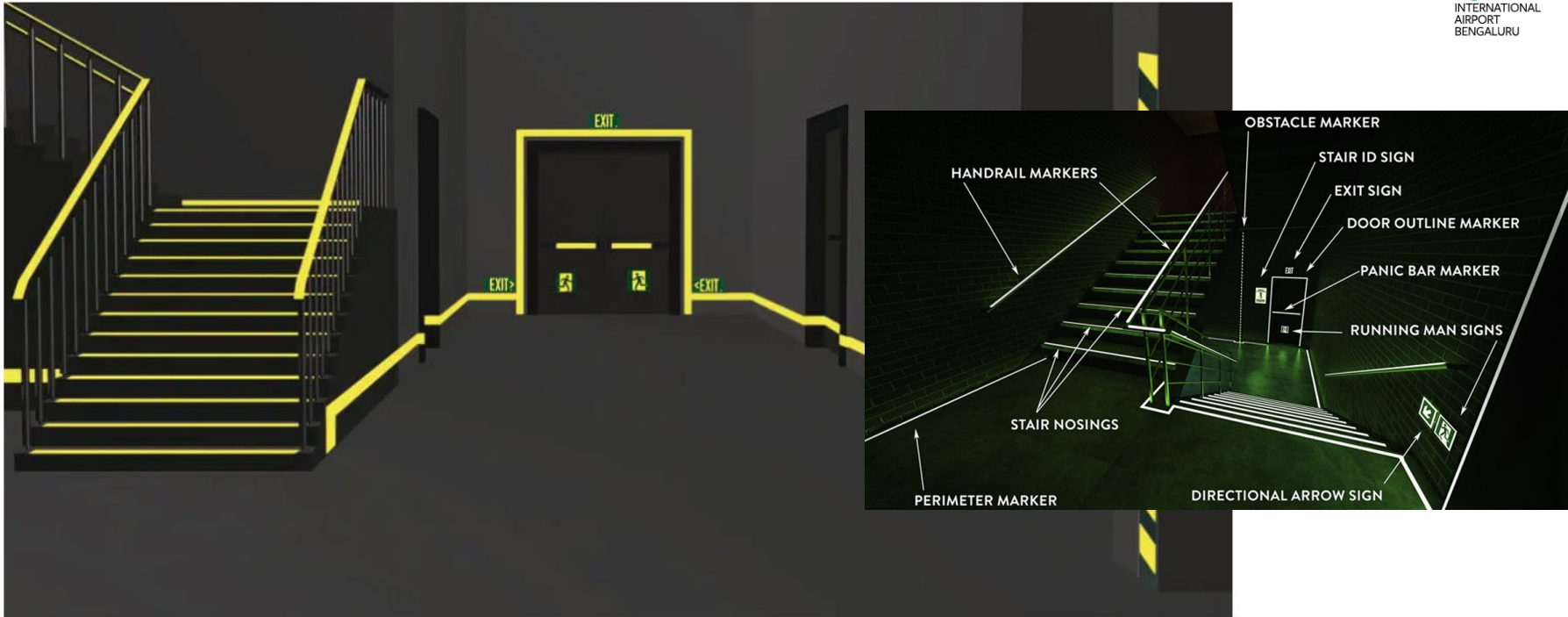
The importance of these drawings arrives from a fact that, when the correct penetration treatments are followed technically then there is no chance of fire or smoke ingress or egress from that said area and affecting the adjoining areas.

# Egress Staircase Drawings and Considerations.

- Consistent Tread and Riser Widths.
- Appropriate indication of turning widths.
- Staircase structure to be greater than a 2-hour rated structure.
- Staircase wall to be a self-supporting core structure without any drywall or void elements and to have its own structural system.
- Drawings to indicate all existing services i.e., FHC and medical niches.
- Power supply to staircase block to have its own circuit independent of the building circuits with a minimum of 90 minutes backup.
- Extraction fans and pressurization will depend on the height of the structure and other codes.
- All drawings to be certified by a registered architect and approved by the local fire authority before construction.



# Egress Staircase Markings.

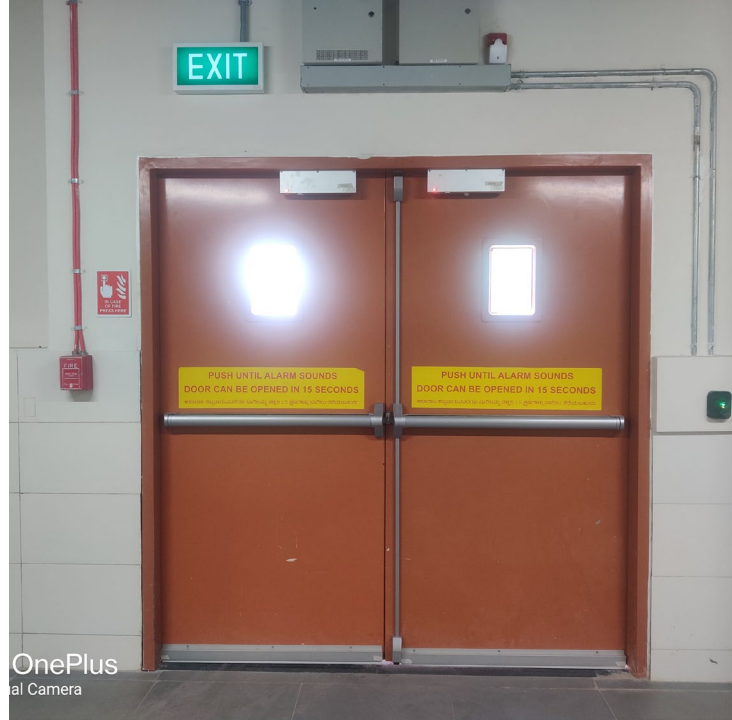


Nationwide Building Code compliant UL1994 listed Egress Path Markings.

- Photoluminescent egress path markings must provide a minimum of 90 minutes of luminance after the building's power has failed – **this is a critical check criteria**



# Terminal-2 – Staircase Egress Doors Signage and Staircase Status.



## System Protocol

### Push Bar

- The push bar once activated by the user triggers action in the control center by having a pop-up CCTV notification.

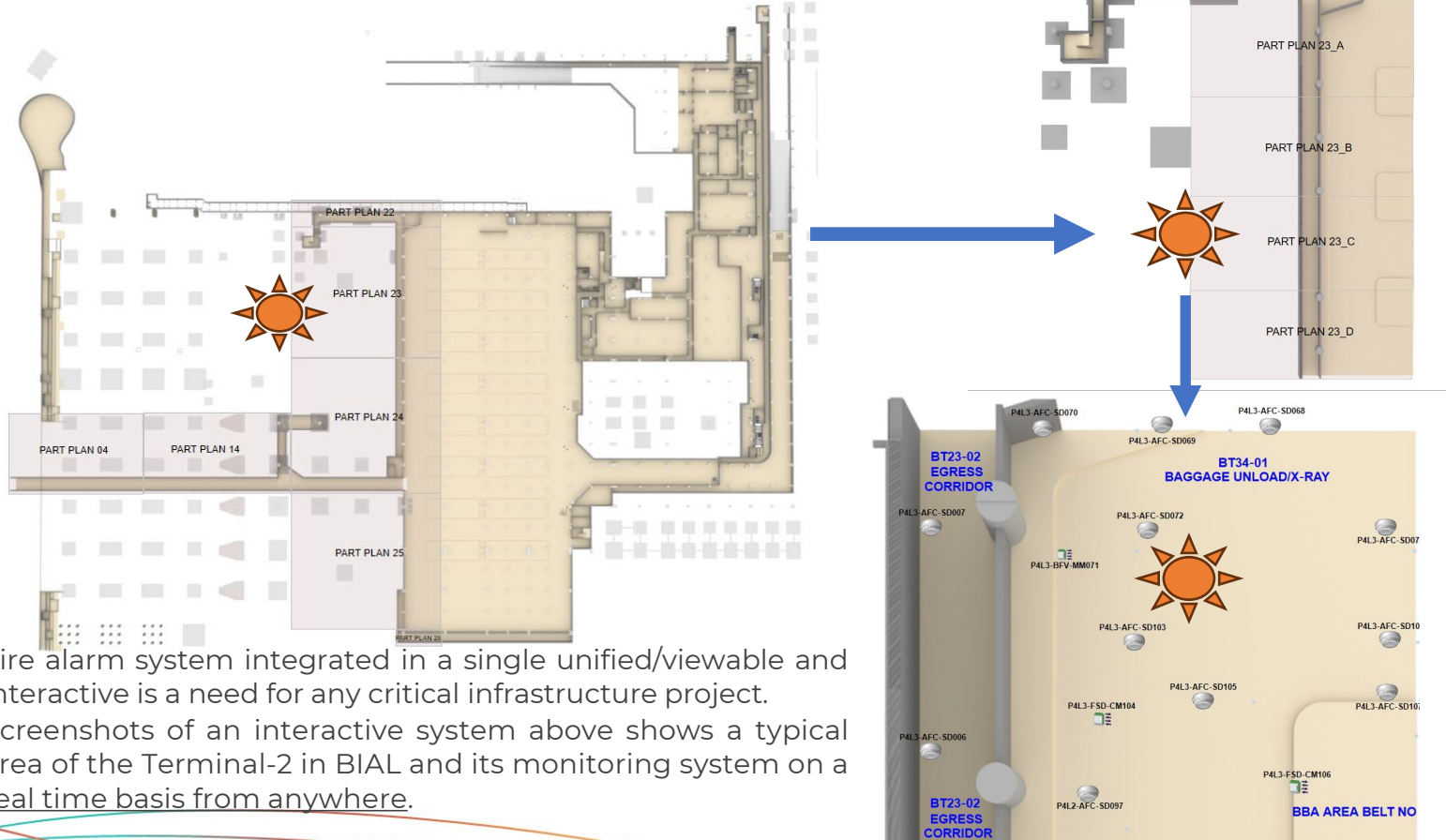
### Waiting Time

- During the waiting time of 15 seconds, the hooter system is prepped to be activated and sequential pop-up CCTV notification to the control center is generated.

### Door Open

- Once the door is opened post the waiting time, hooter remains active, and the door will remain open till a manual reset of the local system is concluded post inspection.

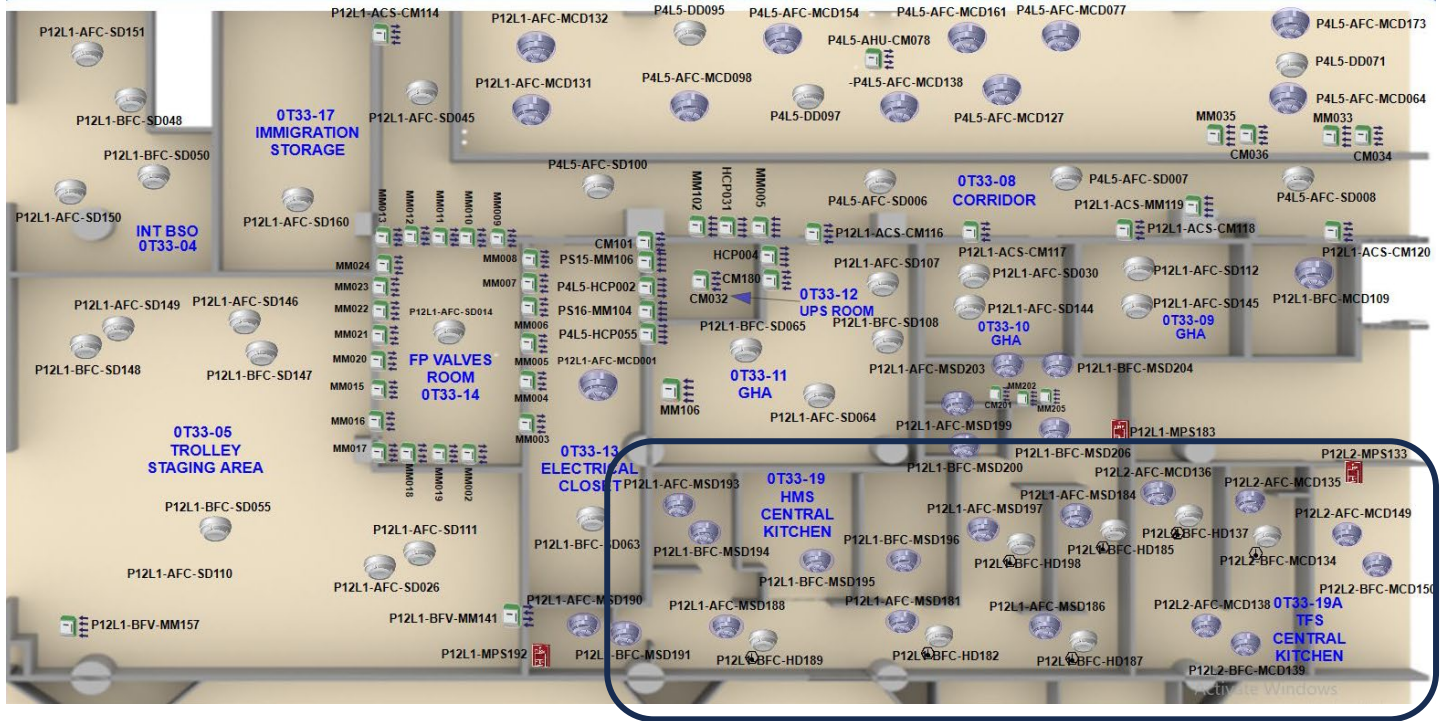
# Fire Alarm System Integration -1.



Fire alarm system integrated in a single unified/viewable and interactive is a need for any critical infrastructure project. Screenshots of an interactive system above shows a typical area of the Terminal-2 in BIAL and its monitoring system on a real time basis from anywhere.



## Fire Alarm System Integration -2.

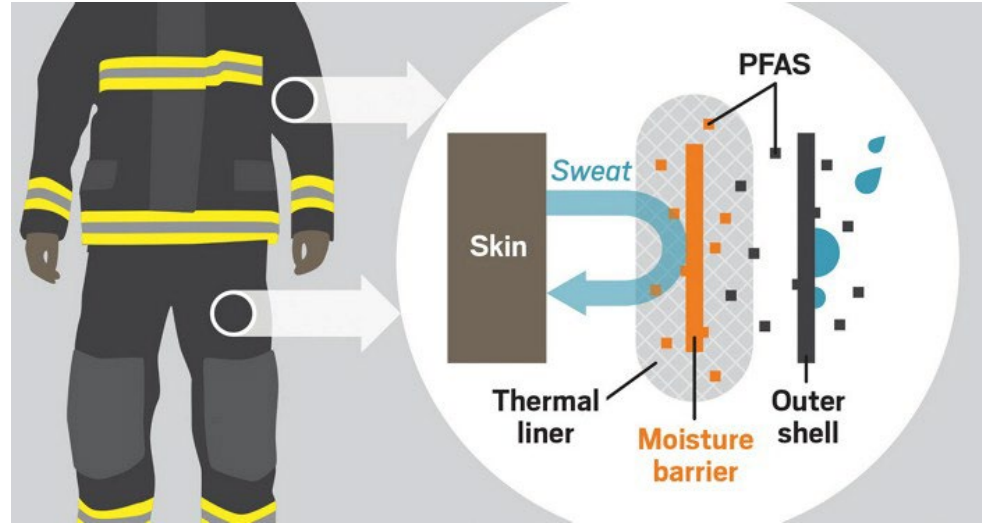


As with any infrastructure project, the FAS system is divided in two specific compartments –

1. **Base Built** – Main structure FAS system.
2. **Additional Built** which may include rented out areas and others – these needs prior planning steps so that proper fire panel expansion and integration with the main base-built panels are streamlined.

## Future Areas of Concern – Personal Safety





PFAS or per- and polyfluoroalkyl substances becomes toxic when exposed to high temperatures, posing significant cancer risks to firefighters including wearing this gear during their duties due to normal wear and tear.



## **Response System for Structural Fires**

### **NFPA 1710**

- Alarm Answering time of 15 seconds – Alarm received and acknowledged, or Phone call attended.
- Alarm processing time of 60 seconds – Message is understood and begins to be transmitted to the response units/crew.
- Turnout Time of 80 Seconds - message received understood by the Emergency response unit or the fire crew and travel begins
- Travel Time of 4 minutes - Emergency Response Unit/Crew is enroute till reaches the scene.
- However, the endeavor is to reach ASAP and below design features support in a quick response.

- **Alert System** – FAS Alarm Panel, GUI, Phone calls and RT sets.

Repeater panels are provided in Fire Stations with GUI for simultaneous monitoring and response.

- **Fire Control Rooms** – Three fire control rooms are strategically provided for efficient response to any fire calls.
  - Ground Floor – Main Control Room
  - Departure hall – Ancillary control Room
  - Arrival hall – Ancillary Control Room

The fire crew are stationed in all the control rooms. The crew from ancillary control rooms turnout for emergency response. They also carryout patrolling & work permit approvals.

Response from Fire Station and the Control room happens simultaneously in coordination. The Crew from the nearest control room responds and other reinforcement reaches behind.

- **Crew Inter-Communication** – RT sets or Mobile phones.

- **Other Arrangements** – Fire Buggy in Departure hall, CAFS & Ladders are placed strategically in various places based on the criticality and fire load.
- **Building features and arrangements** – Fire Rated walls, Compartmentation of critical areas & emergency lighting in access/egress routes. Sprinklers & Hydrants are provided across all floors and periphery of the terminal.
- **FAS Integration** – Emergency exits, Escalators, Lifts, Travelators, Exhaust Fans, Internal Staircase Exhaust system, Pump status, Fire Valve status, Sprinkle flow switches. CCTV in the vicinity of Emergency exits are integrated.
- Bamboo aesthetics are fire retardant rated (2hrs) and 3<sup>rd</sup> party tested (UL).
- Sprinklers are provided below and above the bamboo structures.



THANK YOU

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