March Newsletter

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Planning:

The new integrated Terminal 2 will be a success only due to the unseen facilities within, providing an efficient, safe, seamless and comfortable environment for all passengers.

Comfort was a key factor in the planning of the facilities. It was manifested via air conditioning to control the temperature and humidity, lighting for all spaces within, and equipped systems providing clean water to all passengers. Safety formed another key factor, where facilities handling such large passenger and equipment traffic required mandated systems for fire detection, protection and suppression. Another vital planning factor was efficiency, having a direct effect on the cost of power, operations, maintenance and major repairs. A Building Management System, that offers control over the various facilities improving efficiency, was an important planning input. Planning of the Piped Natural Gas systems was also required in important F&B areas.

The planning structure for the facilities was prepared keeping in mind three passenger parameters - the travel, the dwell and the experience. It stayed true to our vision of having a world class airport that provides the latest facilities for passenger comfort and is the pride of Mumbai.

Design and Engineering

In line with the overall vision, the terminal is designed keeping in mind the finish quality and how different architectural elements interact with each other. The facilities are concealed in non-passenger areas, with a distribution and service network facilitated via series of complicated vertical and horizontal highways such as chases and duct banks. The final intent of all these facilities is to serve the passengers, and they are thus subtly integrated into the internal façade to create a holistic design structure.

Engineering for the terminal applies a set of comprehensive processes and procedures, which results in providing the location, sizing, specification, performance, quality and delivery for each of the services required. Since these facilities are a long-term investment, they are engineered to provide sustainability and longevity, with neither lack of capacity nor lack of technology affecting it. A certain margin of flexibility is allowed so as to factor in growth, wear and tear, and various other concerns that might come up over time.

The major facilities provided within the terminal are:

1) **Public Health Engineering**
2) **Fire Detection and Protection System**
3) **Air-conditioning System**
4) **Electrical System**

Public Health Engineering:

This facility provides the terminal and its occupants with water provisions. These are required throughout the facilities especially in washrooms and F&B areas such as restaurant kitchens. It also takes care of the drainage of sanitary and storm water from the terminal. The water is recycled and is provided back to the facility for flushing and various other activities that does not have any exposure to humans. This is in line with LEED and water conservation principles.

All the services provided by this facility are conducted via pressure controlled piped infrastructure, which is situated within the various zones of the terminal. These zones provide an efficient and hygienic system to manage the facility, ensuring that there is no inconvenience caused to the passengers.

Fire Detection and Protection System

An airport terminal always has added problems when it comes to fire safety as it has to deal with aviation safety concerns. Like a normal building, it has a large number of people using different spaces as office, lounges, hotels, retails, etc. But in addition, there is a vital responsibility to ensure the smooth functioning of an airport.

The objective is to create a highly efficient building which maintains fire and life safety in line with the internationally and nationally recognized standards. The facility offers systems such as fire detection, protection and suppression. Along with this, it offers a quick smoke extraction system in the event of a fire mishap. These are all components of the Fire Egress and Emergency Strategy. This allows the quick detection and isolation of a fire hazard, with the extraction and recovery system allowing the terminal to resume operations at the earliest.

Certain areas in the terminal have high-end equipment, thus employ the specialized Clean Agent suppression system. This suppresses the fire without any damage to the sensitive equipment, thus keeping the recovery time to a bare minimal.

Air-conditioning System

This facility is vital in maintaining a comfortable environment throughout the terminal. It is based on the building and industry codes, LEED efficiencies, and functional design requirements. Touch points for the facility includes humidity and temperature control in passenger area, and life system dependencies.

The engineering for air-conditioning systems, used in large structures like T2, has advanced significantly in the past decade. Areas in the terminal are treated as different spaces with different factors, requirements and functions. They are given due importance based on their functions such as IT, critical services, passengers zone, retails zones, etc.

The AC plants supply chilled water to the AC units in the building, which in turn cools the air that is provided to the terminal. These along with volume control boxes, ducting and grilles, provide the mechanism for an energy efficient air delivery system that is filtered for human use.

In addition, a building management tool is used to monitor and control the various spaces of the terminal.

Electrical Systems

The base component of any structure is the electrical system. It forms the core source of power and energy required to run the building facilities through the use of motors, controllers, starters and various other equipment. The terminal design applies zonal principles based on power loss mitigation, distribution and delivery. The distribution of power for the different facilities and passenger level services is pre-defined, so as to ensure efficient use of the utility and the space.

The engineering for the electrical system is made robust with emergency backups, monitoring systems and safety structures. An efficient solution is guaranteed due to the importance given to every aspect from large gear such as generators, sub-stations, transformers, power distribution panels, down to the smallest component of sockets, lights and switches.

Construction Challenges:

- It is the largest and most complicated facilities effort under a single structural roof.
- Interdependency, time management and co-ordination between the different sections of a brown field project.
- Maintaining the smooth operation of ongoing services, while the complex construction is in progress around it.
- The relocation of water supply used for operations and the sewage pump house to clear area for construction, without affecting operations in the terminal.
- Maintaining the quality of a world class structure, during the installation.
- The use of 3D model devices to co-ordinate high level and underground services, so as to identify conflicts beforehand and not have any interference between the different services.
- The critical requirement of a large labour force and tight space management
- The dynamic nature of the facilities requires testing, commissioning and integration after installation.

Operations and Maintenance

The facilities cover all aspects of services provided to the occupants of the terminal. The operations team has a set of pre-determined necessary services to provide for, with no areas of the facilities deemed wishful. Every system has control, monitoring, safety and security mechanisms, which provides the operations team with the flexibility to conduct services required throughout the terminal. The vast array of services and utilities that make up the facilities, poses a significant operational challenge in maintaining an efficient cost system.

The maintenance structure is efficiently placed on the basis of international standards and

practices. The use of large international and national vendors for the design and delivery of systems is an interesting scheme used to facilitate the work of maintenance teams. This provides the teams with a large base of original equipment manufacturers and suppliers that they can use as future operations and maintenance subcontractors.

Interesting facts:

- The centralized air conditioning plant, that supplies air to the terminal, is of York make and has a refrigerating capacity of 15,000 tonnes.
- 83 air handling units and 500 fan coil units are distributed equally across different locations and levels within the terminal.
- The chilled water piping has a complex distribution network of 28 km, circulating chilled water between the plant room and the terminal.
- The ducting that circulates cold air between the air handling unit and the terminal has a span of 3,00,000 sq. m.
- To deal with fire emergencies, the life safety scheme provides smoke exhaust fans, staircase pressurisation fans and life pressurisation fans.
- The unique use of grooved coupling in the piping of the Fire Protection System (FPS) saves construction time and reduces pollution caused due to welding.
- A sewage treatment plant of 10 million litres per day capacity, based on the Sequential Batch Reactor (SBR) technology, is being implemented for the first time in India.
- Six diesel generator sets of 3 MVA, 11 KV specifications are being installed. They operate in parallel based on the load requirement.
- The use of more than 1,00,000 light fixtures with 85 variants, makes lighting of the terminal an important aspect of all services.
- The departure bay contains approximately 100 imported chandeliers, adding to the ambiance of the terminal.
- The Fire Alarm System (FAS) comprises of 70,000 detection devices with 400 km of cables spread throughout the terminal.
- The FAS is unique in its interfacing with various life safety systems, with more than 18,000 interface modules. The systems are the public address system, electrical system, security system, air-conditioning system, fire protection system, CCTV system, lighting system, VHT, BMS and BHS.

LEED Initiative:

The facilities are designed around key principles of LEED, mainly concentrated around energy consumption and management systems. Few of the LEED associated standards being applied are:

- The lighting control system is implemented on the notion of energy saving through day light harvesting.
- The reflective paint of the roof has R-30 insulation.
- Implementation of efficient water cooled chillers.
- Air distribution based on variable air volume.

- Provision of Variable Frequency Drives (VFD) for the cooling towers, secondary pumps and AHUs.
- Heat recovery system for exhaust air.
- Recycling and recovering of condensate water for the cooling towers.
- Use of permeate from the Sewage Treatment Plant (STP) in the cooling system.
- Employing a rain water harvesting system to use for flushing and to increase the ground water level.
- Implementation of the advanced hydro-pneumatic system for domestic and recycled water distribution, drastically reducing the use of electricity.
- Use of recycled water for flushing purposes within the terminal.
