

PROPOSED DOMESTIC AIRPORT AT NEVALI, KALYAN.

By

RAJAT MOHAN NAIR

A REPORT

Submitted in partial fulfillment of the requirements for the degree of
Bachelor of Architecture.



University of Mumbai

2017

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AIKTC 
SCHOOL OF ARCHITECTURE

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Name of the guide: **Prof. Yezdi. V. Karanjawala**



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Naturally, any errors are mine alone.



1. Abstract

Airport plays an important role in global transportation. Airports becomes platforms that generates revenue in aviation as well as commercial activities. Over the previous couple of years, there is a major increase in commercial air travel. Introduction of many new airline companies and decrease in the cost of aviation fuels acted as a catalyst to reduce the fares, which was the reason for the increase in demand for commercial air travel. As there is increase in demand for air travel there are demands for new and efficient airports.

Civil aviation industry in India is on a growing every year. By 2026 India is aiming to become the 3rd largest aviation market. India has already become fastest growing domestic travel market in the world, by recording year-to-year growth of 26.6 % (as on January 2017), according to the IATA.

Airports becomes a gate way to a country. It represents the place as it is the first thing a person sees after approaching. It is important for the airport to symbolise the place. Along with it, it is equally important for that airport to become user-friendly. Objective of thesis is to take a “human-centric” approach to transport. Human-centric design puts the user directly at the core of the design. Also, to create efficient and resilient transport solutions that are mutually beneficial for both passengers, operators and all the other users in an airport and also to develop a deeper understanding of experience of different categories of users in the building. Apply the outcomes of this research towards developing design principles that can be used to optimize the allocation of spaces from a perspective of a user’s experience.

2. Introduction

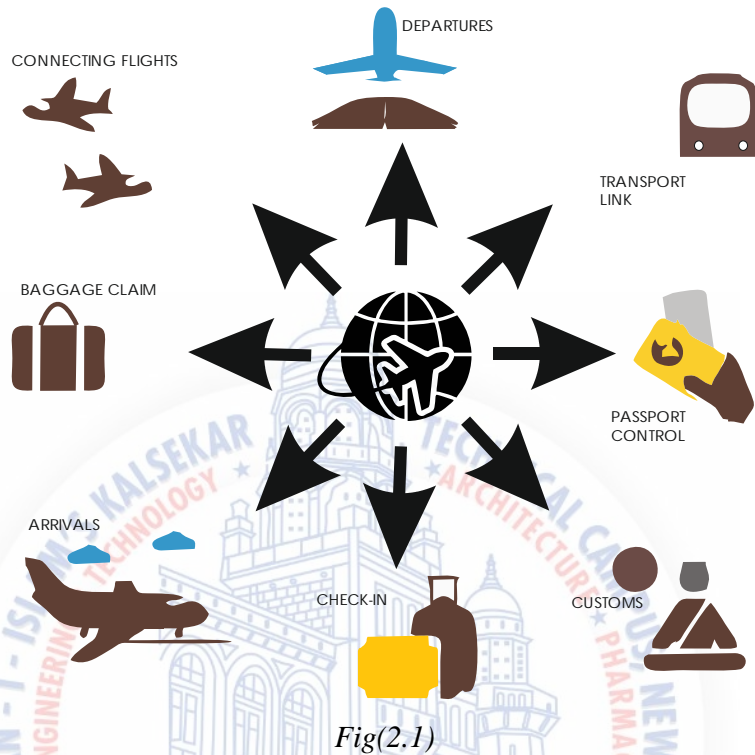
Two decades ago air travel was limited to a selected set of people, officers and bureaucrats. There was a complete monopoly of public sector civil aviation corporations. Air travel at that time was very costly. At a point of time, when the countries per capita income was hardly ₹5000 per annum, one sided air fare from Delhi to Mumbai was between ₹6000 and ₹10,000. Time has changed with a big number of low cost private aviation companies entering into the market, leading to big reduction in fares and number of passengers multiplied. Today, when per capita income in the country is nearly ₹1,00,000 annually, one can travel between Delhi and Mumbai for a mere ₹2100 (if booking is made well in advance).

However, Indian companies have been facing huge problems due to cut-throat competition. It is notable that this cut-throat competition forced India's first private sector aviation company 'Air Deccan' to 'Kingfisher' another aviation company, which itself went into bankruptcy later. Thanks to lower petroleum prices, these companies have again started earning profits. However, we must understand that this situation is not going to last forever.

New technology has improved the safety and efficiency of airports. Today flights leave and arrive at under two-minute intervals, resulting in 80 flights an hour with an airport of two runways (Oslo) or 90 with three (Chicago). This can result in influxes of passengers of around 10000 per hour, or about a quarter the capacity of a football stadium. Such volumes are only possible with modern widely spaced runways (usually 2 km apart), with modern methods of baggage handling and people movement. However, whereas new technology on the ground and in the air has speeded up movement bringing turnaround times for aircraft to twenty minutes, greater concern for security has slowed down the throughput of passengers and their baggage. New safety checks, instigated which helps passengers pass through to the departure lounge without being subject to an X-ray scan. Speed and security are often in conflict, adding to frustration for passengers and airline staff alike.

Air-travel is a product of 4 related factors: the supply of people, the need to travel, the resources available to spend, and the existence of an airline transport infrastructure. These four factors operate in different ways in different regions of the world. Whereas in the West the infrastructure exists and an increasing percentage of people can afford to travel, in the Pacific Rim and Asia more people can afford to fly than before but the airport infrastructure is not adequately established to serve their needs. Also, the need to travel is dependent upon the existence of an economy that requires business travel, or a tourist industry that provides holiday destinations served by air.

2.1.1 Background Study



Fig(2.1)

WHAT IS AN AIRPORT?

Airports are large, complex and generally highly profitable industrial enterprises. They are part of a nation's essential transportation infrastructure, which, besides providing thousands of jobs at the airport itself, supports a much broader audience in social and economic terms. It has been estimated that for every job at the airport, an additional one is created in the region. As large industrial complexes, airports consist primarily of:

- runways and taxiing areas
- air traffic control buildings
- aircraft maintenance buildings
- passenger terminals and car parks
- freight warehouses

For an architect, the passenger terminal is the main airport building and an opportunity for architectural expression. Organizationally, the terminal building is the key element within the airport estate. It is, however, just part of an integrated system, which involves a complex interaction between airline companies, airport authorities and the traveller. The reputation of an airport is, determined by the quality of its terminal buildings, not just as architectural imagery but also in terms of customer needs.

History of airport

The earliest aircraft take off and landing sites were grassy fields. The plane could approach at any angle that provided a favourable wind direction. A slight improvement was the dirt only field, which eliminated the drag from grass. However, these only functioned well in dry conditions. Later, concrete surfaces would allow landings, rain or shine, day or night.

Evolution of airport over period of time:



San Carlos Airport

(fig.2.2)



Cleveland Airport 1929

(fig.2.3)



JFK Airport 1953

(fig.2.4)



Bangkok Suvarnabhumi Airport 2006

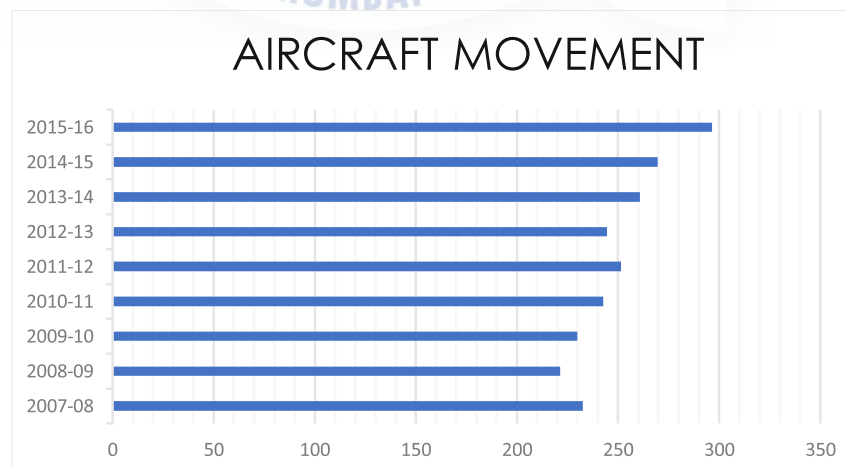
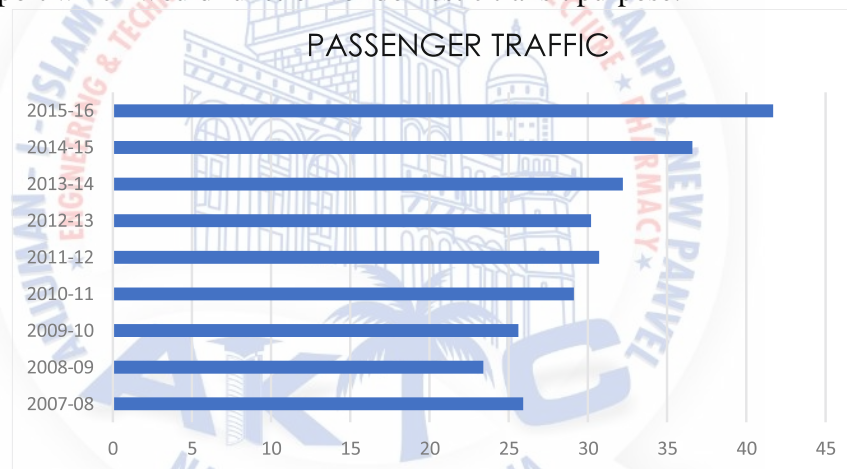
(fig.2.5)

There is a remarkable evolution in airports over the past century small airdromes became huge massive structures.

2.1.2.a. Problem Statement

The main aviation hub in Mumbai is the CSIA. It is second busiest airport in India in terms of passenger traffic. Annually the airport handled 36.6 M passengers in 2005. After which an upgrade plan was initiated which targeted to increase the capacity of the airport to handle up to 40 M passengers annually which was initiated in 2006. The new terminal was open in 2014. But soon the airport reached its limit of 40M passengers for which it was originally designed which became 42.5M just in 2 years. A new airport in Navi Mumbai was proposed to decrease the load in the Mumbai Airport.

The new airport is being designed with the capacity of 10 million passengers annually. If we take a look on to the growth of passenger traffic in Mumbai a growth of 3 million passengers on an average is visible. Which means the current passenger count of 42 million will be approximately 60 million in next 6 years. In addition to it, the central government is planning for a regional connectivity scheme which might add on to the air traffic in the near future. Because of this there is a need of a new airport which would function for domestic transit purpose.



2.1.2.b. AIM

To propose an airport at Nevali located at Kalyan, 50km from Mumbai.

2.1.3 OBJECTIVE

Taking a "human" approach to transport. Human-centered mobility puts the user directly at the heart of design and decision making. Create efficient and resilient transport solutions that are mutually beneficial for both passengers, operators and all the other users. Develop a deeper understanding of the user experience in the building. Apply the outcomes of this research towards developing design principles that can be used to optimize the allocation of spaces from a user experience perspective.

2.1.4 METHODOLOGY

Understanding airport functions, taking surveys related to peoples experience in airports around India. The human centric approach to design to be followed, the research and survey to be based on following pointers.

- User experience
- Importance of User experience
- Using user experience for shaping the design

2.1.5 SCOPE

As airports forms a gate way to the city, the solution could become a landmark to represent the city. Also, to explore with new structural systems. Experimenting with materials.

2.1.6 LIMITATION

Majorly the focus will be on the passenger terminal building. The deeper technicalities of runway and aeroplanes won't be part of the thesis.

2.2. Literature review

2.2.1 Definitions & Descriptions

1. **Airport** - An area of land (including buildings, runways and control towers) for the arrival or departure of aircraft.
2. **Airport Roads** - Network of public and private roads providing access to airport buildings and areas.
3. **Airside** - Area under government or airport control providing access to aircraft, and prohibited to non-traveling public.
4. **Apron** - Paved area on airside where aircraft are parked.
5. **Arriving passenger** - A passenger arriving at terminal by air.
6. **Baggage** - The personal property of a passenger.
7. **Carousel** - Rotating baggage-claim device.
8. **Concessions** - Passenger amenities provided by retail, food services etc.
9. **Concourse** - Open space or hall in passenger terminal, used for circulation or waiting.
10. **Departing passenger** - A passenger departing from a terminal by air.
11. **Deplaning** - To disembark from an airplane.
12. **Domestic flight** - Flight within a single country not involving government control.
13. **Dwell time** - Time that a passenger spends in a terminal.
14. **Enplaning** - To board an airplane.

CM keen on developing Kalyan airstrip for flights within state

Soubhik Mitra
soubhik.mitra@hindustantimes.com

MUMBAI: A defunct airstrip in Kalyan may become the city's third airport, albeit for short flights — mostly within Maharashtra.

On Wednesday, the issue of the World War II airstrip surfaced during a discussion between state aviation minister Jayant Sinha and chief minister Devendra Fadnavis.

"We want to develop the Kalyan airstrip under the regional air connectivity scheme," Fadnavis told HT, adding that the state will talk to the defence ministry which owns the land.

Under the regional connectivity scheme named UDAN (Ude Desh ka Aam Nagrik, the common man should fly), the ministry is planning to revamp India's ghost airports. Records indicate that there could be more than two dozen unused airstrips.

Last week, the government invited bids from airlines willing to operate short distance flights (up to 500 km) at fares not exceeding Rs2,500 for an hour of flying under the scheme. Unlike the Juhu aerodrome, which requires extension of the runway and resolving some licencing issues, the 1,700-foot-long Kalyan airstrip had less development hurdles, said ministry sources.

The proposal for the airstrip first had come up as an alternative to the yet-to-start Navi Mumbai airport but the Praful Patel ministry dismissed the idea

It surfaced again when a local municipal councillor wrote to the civil aviation secretary about its advantages over the Panvel airport but the proposal got shot down again

It returned to the drawing board in August following an aerial survey of the airstrip by civil aviation minister Ashok Gajapati Raju.

ministry dismissed the idea

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It returned to the drawing board in August following an aerial survey of the airstrip by civil aviation minister Ashok Gajapati Raju.

BEST RELAXES PASS RULES FOR FESTIVE SEASON

HT Correspondent
hmetro@hindustantimes.com

MUMBAI: To ease your suburban bus travel during Diwali, Brihanmumbai Electric Supply and Transport (BEST) undertaking will issue day-passes from October 29 to November 1 without radio frequency identification (RFID) cards, which are similar to the ATVM cards used for the suburban rail network.

The RFID smart card is mandatory to purchase passes for week-days. However, for commuters' convenience, BEST is allowing day-passes without RFID card during the festive season. The daily day-pass for entire Mumbai costs Rs70, while it is Rs40 for only Island City and Rs50 for the suburbs. Meanwhile, commuters can also avail the benefit of happy hours — 11am to 5pm. During the happy hours, commuters will have to pay only half of the day-pass price.

MMRDA conducts monorail trial

The Mumbai Metropolitan Region Development Authority on Thursday conducted a trial of the monorail between GTB Nagar station and Mint Colony on the Wadala- Jacob Circle corridor. According to officials, the trial was carried out from 11.30am to 2pm, during which, the monorail passed through areas such as Dadar and Parel for the first time

CENTRE'S REGIONAL CONNECTIVITY SCHEME

The state signed an agreement with the civil aviation ministry to develop 10 almost non-functional regional airports/airstrips under the Centre's regional connectivity scheme

The proposed airports are Kolhapur, Shirdi, Amravati, Gondia, Nashik, Jalgaon, Nanded, Solapur, Ratnagiri and Sindhudurg

The Centre will provide 80% funding

These airports will be provided with road, rail, metro and waterway corridors to ensure smooth connectivity with major airports

India has more than 30 non-operational airports and more than 400 airstrips dating back to World War II.



state to decrease the air traffic. Doral Air Express during World increase in Mumbai's air traffic. tions can be held at Kalyan" said



Home » Cities » Mumbai » Kalyan: Cops, villagers injured as protests turn violent

Kalyan: Cops, villagers injured as protests turn violent

Residents of seven villages were agitating against Navy orders to vacate over 1,600 acres of land belonging to it.

Written by **Mohamed Thaver** | Kalyan | Updated: June 23, 2017 1:22 am



The protesting villagers attacked policemen and set fire to their vehicles, at the Nevali junction on Thursday. Deepak Joshi

NEARLY 12 police personnel, five of them women, and 13 villagers sustained injuries after residents of seven villages in Kalyan attacked policemen and torched their vehicles, bringing traffic to a standstill on the Kalyan-Haji Malang road Thursday morning. Among the injured, one villager who sustained a pellet injury to his head and an assistant police commissioner are recuperating in hospital.

The villagers were protesting after being told to vacate over 1,600 acres of land belonging to the Navy. For the last four months, said a naval spokesperson, the Navy had been building fencing walls around the area to prevent further encroachment of the land.

According to the police, residents of seven villages in Kalyan had approached the local Hill Line police station Wednesday for permission to conduct a silent protest at Nevali against "their land being taken over by the Navy".

On Thursday morning, a staff of around 40 policemen headed by an assistant commissioner of police had been present at the Nevali junction since 8 am in anticipation of the protest. The fact that there was a police conference on Thursday meant that several policemen had to report to the Thane police head office, leading to fewer men on the spot, said an officer.

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Thieves Decamp With Ram Rahim's Dress, Shoes From Jhajjar Dera
 Oct 02, 2017 09:29 IST

- Kuwait releases 22 Indian prisoners, commutes sentences of 97 others
Oct 02, 2017 09:27 IST
- Aussie skipper Steve Smith blames batsmen, warns players after big loss
Oct 02, 2017 09:18 IST
- Uttar Pradesh cop held for attempting to rape 7-year-old inside police post
Oct 02, 2017 08:16 IST
- 9-year-old dea
 ceasefire in Pr
Oct 02, 2017 09:13
- In movies, sor
 culture rock
Oct 02, 2017 08:40
- CBI faces shor
 heavy worklo
Oct 02, 2017 08:23



According to officials close to the development, the proposed land can be used to operate small aircraft. (Picture for representation)



A third airport on Mumbai's outskirts may soon be a reality, as the Maharashtra government is considering an abandoned airstrip and a 730-hectare plot in Kalyan to be developed as a domestic terminal.



Maharashtra CM keen on developing Kalyan airstrip under regional air connectivity scheme

Updated: Oct 28, 2016 11:15 IST

By Soubhik Mitra



A third airport on Mumbai's outskirts may soon be a reality, as the Maharashtra government is considering an abandoned airstrip and a 730-hectare plot in Kalyan to be developed as a domestic terminal.

The move comes after it was found that the existing airports in Santacruz and Sahar have reached a point of saturation and may not be able to handle additional traffic till the Navi Mumbai International Airport (NMIA) is operational, which is expected to happen only in 2020.

The city has an aerodrome at Juhu. However, it is only used by helicopters and chartered planes. It cannot be used for passenger flight operations, mainly due to its limited size.

The central government's plan to boost regional airport connectivity by building 50 new airports at small towns in the next three years will substantially add to the existing load at Mumbai's airports. As such, the state government wants to develop an additional airport immediately, to decrease the air traffic at the city.

"We expect a significant increase in Mumbai's air traffic after airports are built at small towns under the regional airport connectivity plan. As the Navi Mumbai Airport is not expected to be ready soon, we need a new airport. Domestic flight operations can be held at Kalyan," said Swadheen Kshatriya, chief secretary of the state.

According to officials close to the development, the proposed land can be used to operate small aircraft.

2.2.3. Case Studies

1. CHHATRAPATI SHIVAJI INTERNATIONAL AIRPORT (CSIA) – T2, MUMBAI.

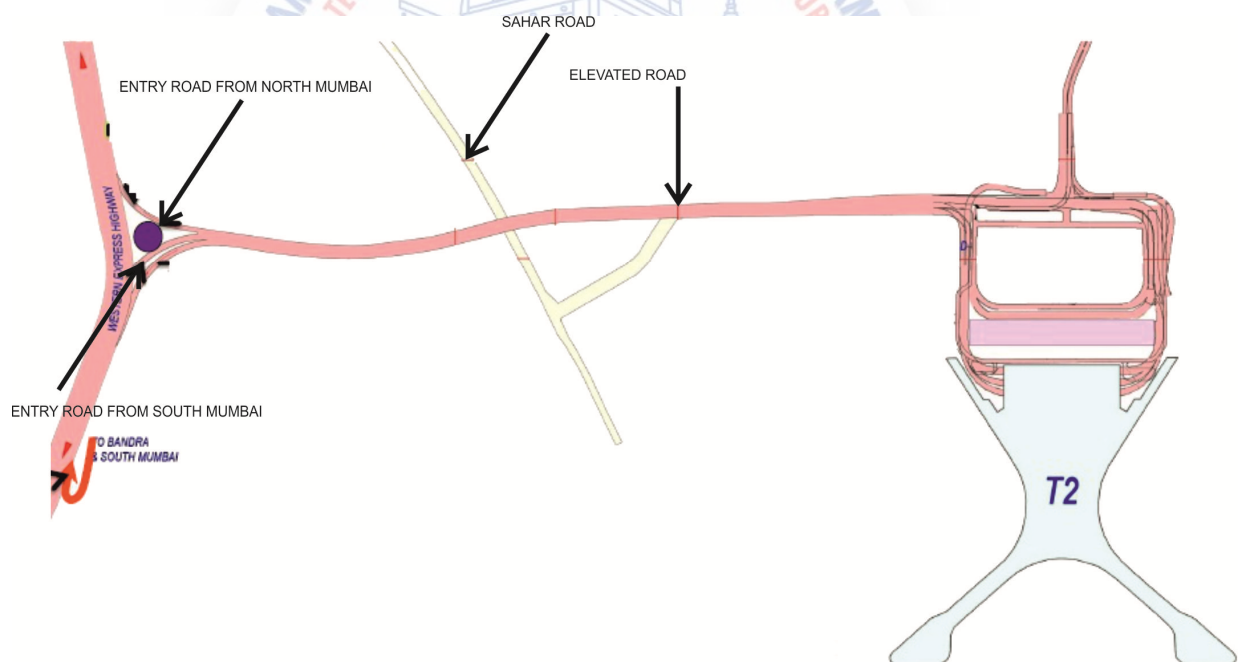
Project details

Year of construction: 2014

Project architect : S.O.M. Architects

Site area : 750 Ha.

No. of levels : 4



access to the airport (fig.2.11)

About the project...

The structure is filled with answers to the local background, history and culture. Large drop off areas designed for large escort groups who accompany the passengers. Spaces specially for the traditional arrival and departure ceremonies of India.



Fig 2.12

Terminal 2 comprise of 4.4 million square meters built up space to accomodate 40 million passengers a year, operating 24 hours a day. The terminal combines international and national passenger services, under a single roof, optimizing terminal operations and reducing passenger distances. Inspired by the shape of the traditional Indian pavilions, the new four-storey terminal stacks a large "main house" or a central processing podium, above the highly adaptable and modular rooms below. Instead of compartmentalizing terminal functions, all hubs are radiated outward from a central processing core and are therefore easily reconfigured to "flicker" between national flights or international flights.

The privileged location of the airport within the city of Mumbai gives it a strong presence within a part of the city that is experiencing rapid growth and upgrading. By integrating into the current transport network and promoting connectivity through the simultaneous development of a new road network to serve the airport, the terminal helps connect the historic heart of Bombay to the south with the thriving suburbs of the city and

north. The check-in hall leads to a retail hub a common space that allows passengers to shop, eat, and watch planes take off though expansive, floor-to- ceiling windows. the terminal core, these commercial plazas provide a focal point of activity in close proximity to the gates. Within these spaces and throughout the concourses, culturally referential fixtures and details, such as custom chandeliers inspired by the lotus flower and traditional mirror mosaic work created by local artists, ground the traveler to a community and culture beyond the airport.

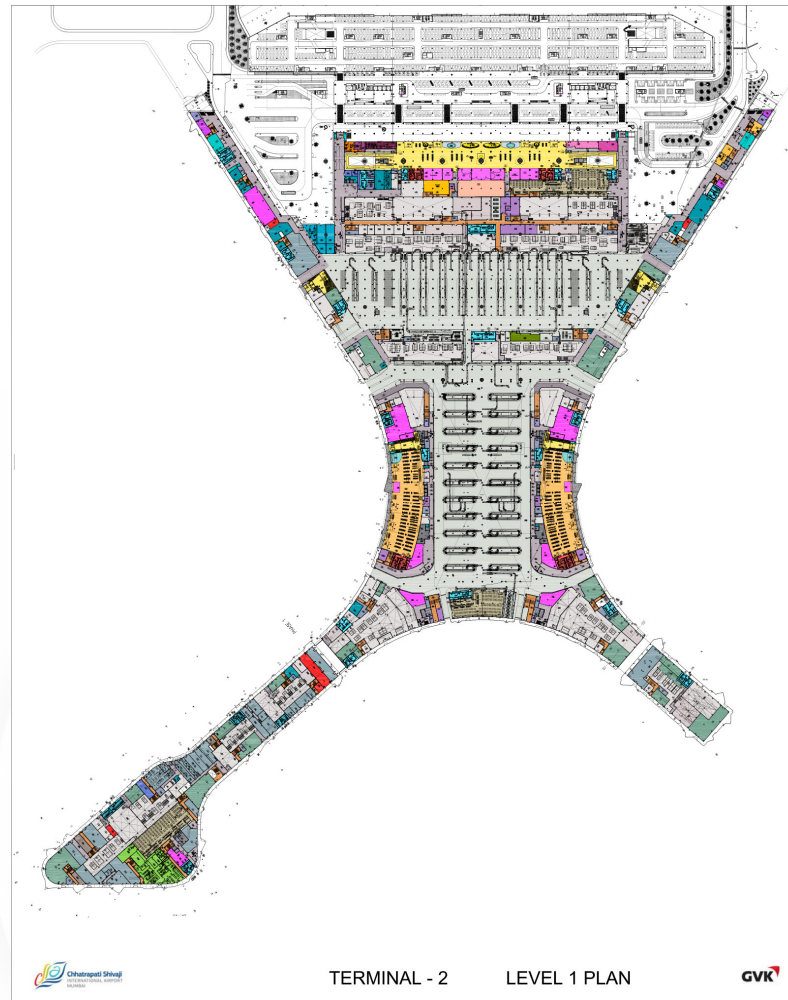


Fig (2.13)

LEGEND -			
■ PUBLIC CIRCULATION	■ STAFF TOILETS	■ TERMINAL MANAGEMENT	■ MEP
■ EGRESS	■ CUSTOMS & AGRICULTURE	■ TRANSIT - DAY HOTEL	■ SUBSTATION ROOM
■ PUBLIC TOILET	■ SECURITY OFFICES / SUPPORT	■ BUSINESS CENTER	■ FA ROOM & FAN ROOM
■ GATE LOUNGE	■ AIRPORT OPS CONTROL CENTER	■ TICKET SALES AREA	■ INCOMING SERVICE PARK
■ FIXED BRIDGES	■ FACILITIES MAINTENANCE	■ DUTY FREE STORAGE	■ HYDRONICS ROOM
■ COMMERCIAL RETAIL	■ MEDICAL STATION	■ POLICE STATION	■ CLEAN AGENT
■ FOOD & BEVERAGE	■ ART ROOM	■ PORTER SERVICES	■ UPS ROOM
■ DUTY FREE	■ COMMERCIAL SERVICES	■ MIAL UNASSIGNED	■ SWITCH GEAR
■ RETAIL SEATING	■ SPECIAL EVENTS	■ RAMP OPERATION AREA	■ OPERATIONS & MAINTENANCE
■ COMM. RETAIL STORAGE	■ MEDIA CENTRE	■ STAFF LOCKER ROOM	■ HOT WATER HEATER ROOM
■ TRASH CHUTES AND STORAGE	■ INFORMATION / CUSTOMER SERVICE	■ BAGG. HANDLING	■ PUMP ROOM
■ DOCKS SCREENING RECEIVING	■ ARRIVALS FACILITIES	■ GROUND HANDLING	■ MCR ROOM
■ AIRLINE CIP LOUNGE	■ CIP LOUNGE	■ AIRCRAFT LINE MAINTENANCE	■ IT ROOM
■ CEREMONIAL LOUNGE	■ GENERAL SEATING	■ TELECOM CLOSET	■ WATER TANK
■ MIAL LOUNGE	■ F&B SEATING	■ LOW VOLTAGE CLOSET	
■ SMOKING LOUNGE	■ POST OFFICE	■ ELEVATOR	
■ PRAYER ROOM	■ LOST & FOUND	■ SERVICE CIRCULATION	
■ ARRIVALS LOUNGE	■ LEFT LUGGAGE ROOM	■ ENGINEERING MAINTENANCE	
■ AOC	■ BAGGAGE CART STORAGE	■ AIRSIDE SAFETY OFFICE	
■ MIAL OFFICES & SUPPORT	■ BANK / CURRENCY EXCHANGE	■ AIRSIDE CANTEEN	
■ AIRLINE OFFICES	■ CISF	■ FIRE TENDER & FIRE ALARM ROOM	
■ TRAVEL SERVICES	■ PROMOTION		
■ IMMIGRATION & HEALTH	■ FOREIGN EXCHANGE		
	■ LACTATION LOUNGE		

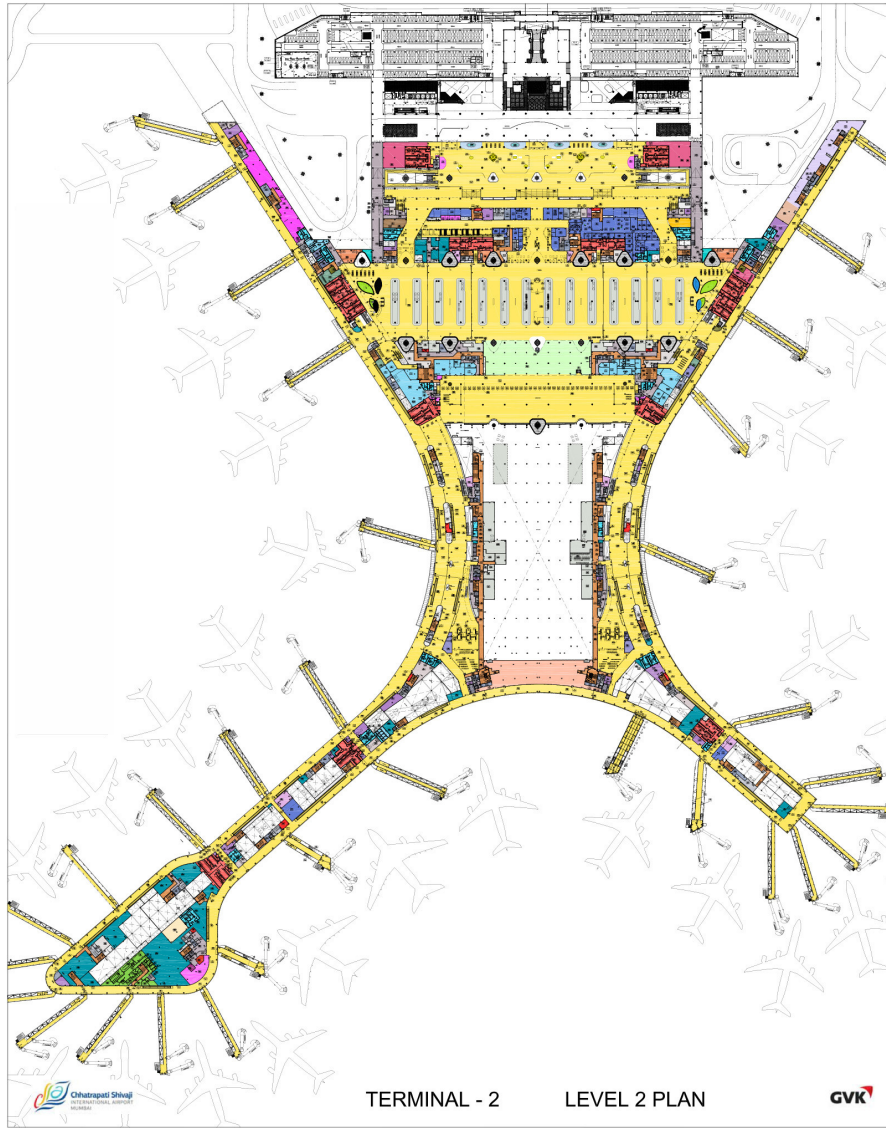


Fig (2.14)

LEGEND :-			
Public Circulation	Staff Toilets	Terminal Management	MEP
Egress	Customs & Agriculture	Transit - Day Hotel	Substation Room
Public Toilet	Security Offices / Support	Business Center	FA Room & Fan Room
Gate Lounge	Airport Ops Control Center	Ticket Sales Area	Incoming Service Park
Fixed Bridges	Facilities Maintenance	Duty Free Storage	Hydronics Room
Commercial Retail	Medical Station	Police Station	Clean Agent
Food & Beverage	Art Room	Porter Services	UPS Room
Duty Free	Commercial Services	MIAL Unassigned	Switch Gear
Retail Seating	Special Events	Ramp Operation Area	Operations & Maintenance
Comm. Retail Storage	Media Centre	Staff Locker Room	Hot Water Heater Room
Trash Chutes and Storage	Information / Customer Service	Bagg. Handling	Pump Room
Docks Screening Receiving	Arrivals Facilities	Ground Handling	MCR Room
Airline CIP Lounge	CIP Lounge	Aircraft Line Maintenance	IT Room
Ceremonial Lounge	F&B Seating	Telecom Closet	Water Tank
MIAL Lounge	Post Office	Low Voltage Closet	
Smoking Lounge	Lost & Found	Elevator	
Prayer Room	Left Luggage Room	Service Circulation	
Arrivals Lounge	Baggage Cart Storage	Engineering Maintenance	
AOCC	Bank / Currency Exchange	Airside Safety Office	
MIAL Offices & Support	CISF	Airside Canteen	
Airline Offices	Promotion	Fire Tender & Fire Alarm Room	
Travel Services	Foreign Exchange		
Immigration & Health	Lactation Lounge		

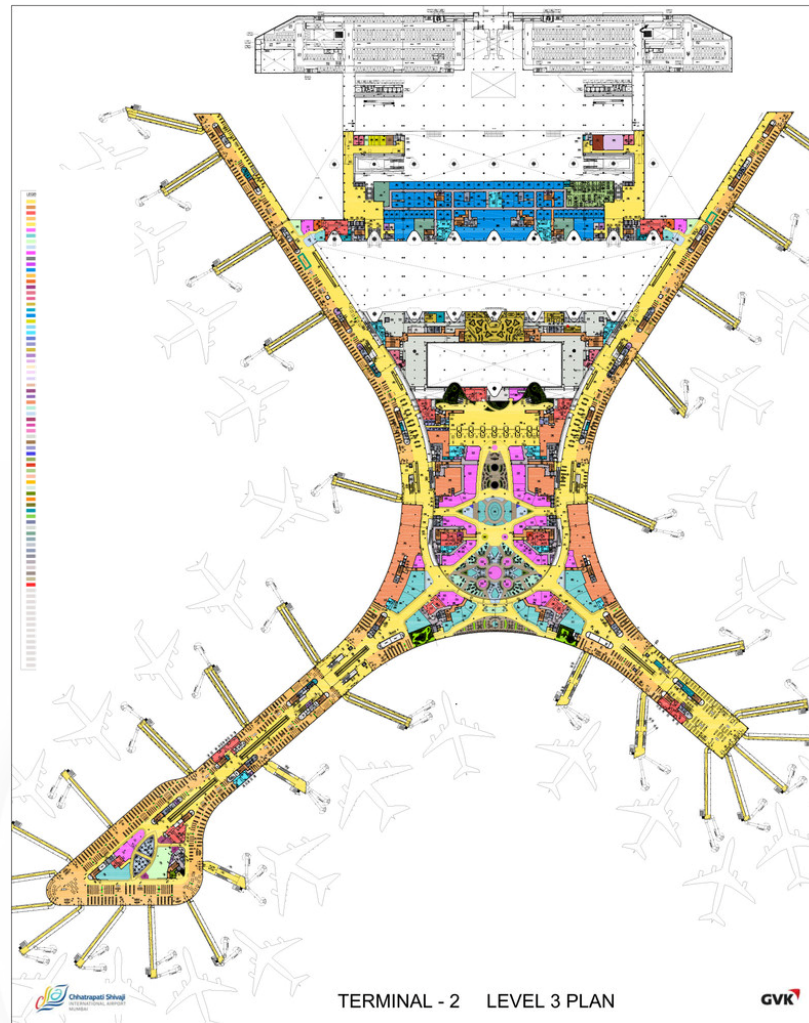


Fig (2.15)

LEGEND :-			
■ PUBLIC CIRCULATION	■ STAFF TOILETS	■ TERMINAL MANAGEMENT	■ MEP
■ EGRESS	■ CUSTOMS & AGRICULTURE	■ TRANSIT - DAY HOTEL	■ SUBSTATION ROOM
■ PUBLIC TOILET	■ SECURITY OFFICES / SUPPORT	■ BUSINESS CENTER	■ FA ROOM & FAN ROOM
■ GATE LOUNGE	■ AIRPORT OPS CONTROL CENTER	■ TICKET SALES AREA	■ INCOMING SERVICE PARK
■ FIXED BRIDGES	■ FACILITIES MAINTENANCE	■ DUTY FREE STORAGE	■ HYDRONICS ROOM
■ COMMERCIAL RETAIL	■ MEDICAL STATION	■ POLICE STATION	■ CLEAN AGENT
■ FOOD & BEVERAGE	■ ART ROOM	■ PORTER SERVICES	■ UPS ROOM
■ DUTY FREE	■ COMMERCIAL SERVICES	■ MIAL UNASSIGNED	■ SWITCH GEAR
■ RETAIL SEATING	■ SPECIAL EVENTS	■ RAMP OPERATION AREA	■ OPERATIONS & MAINTENANCE
■ COMM. RETAIL STORAGE	■ MEDIA CENTRE	■ STAFF LOCKER ROOM	■ HOT WATER HEATER ROOM
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■ AIRLINE OFFICES	■ CISF	■ FIRE TENDER & FIRE ALARM ROOM	
■ TRAVEL SERVICES	■ PROMOTION		
■ IMMIGRATION & HEALTH	■ FOREIGN EXCHANGE		
	■ LACTATION LOUNGE		

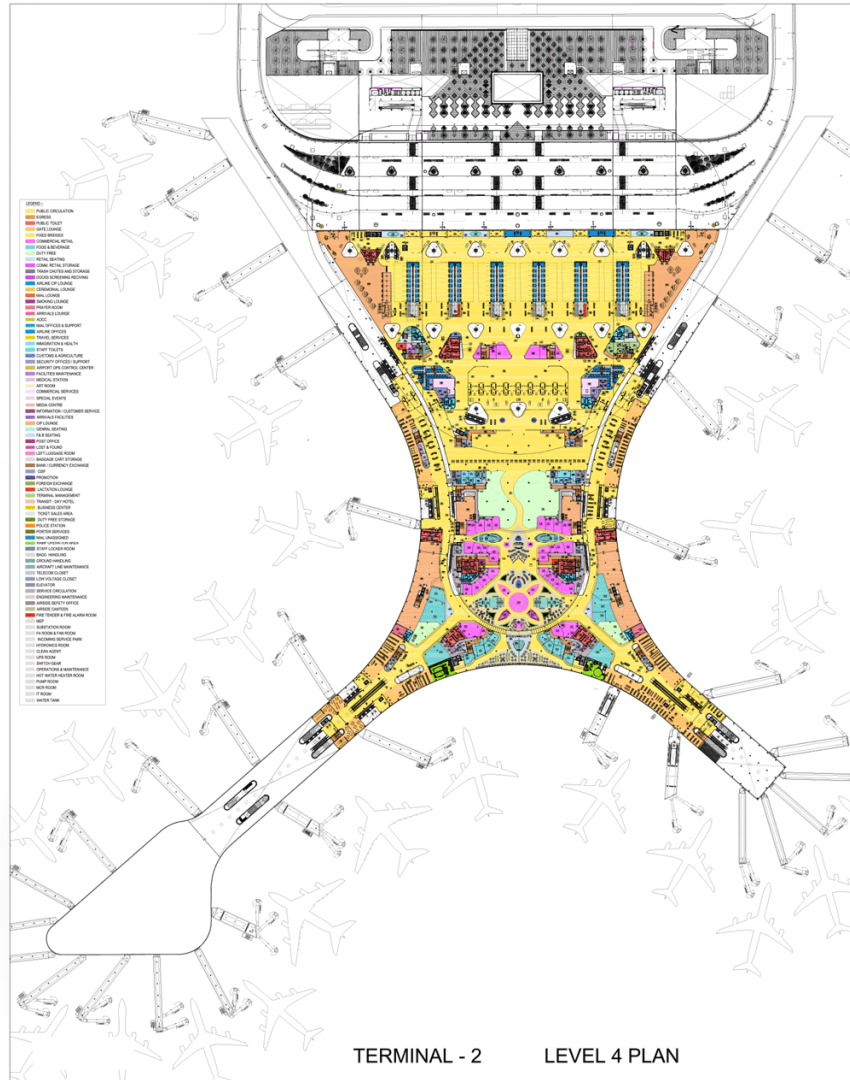
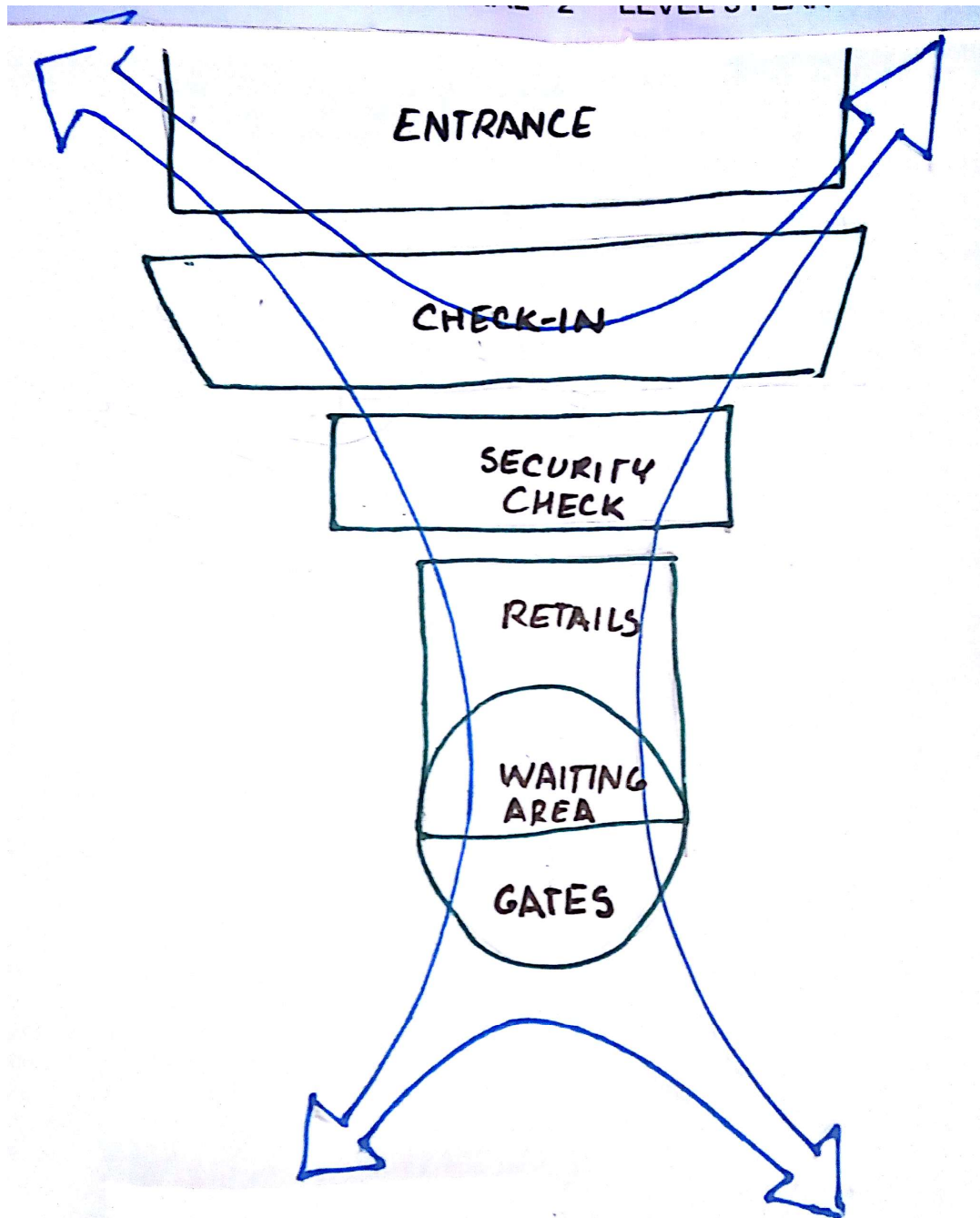


Fig (2.16)





Geometry and layout

Fig (2.17)

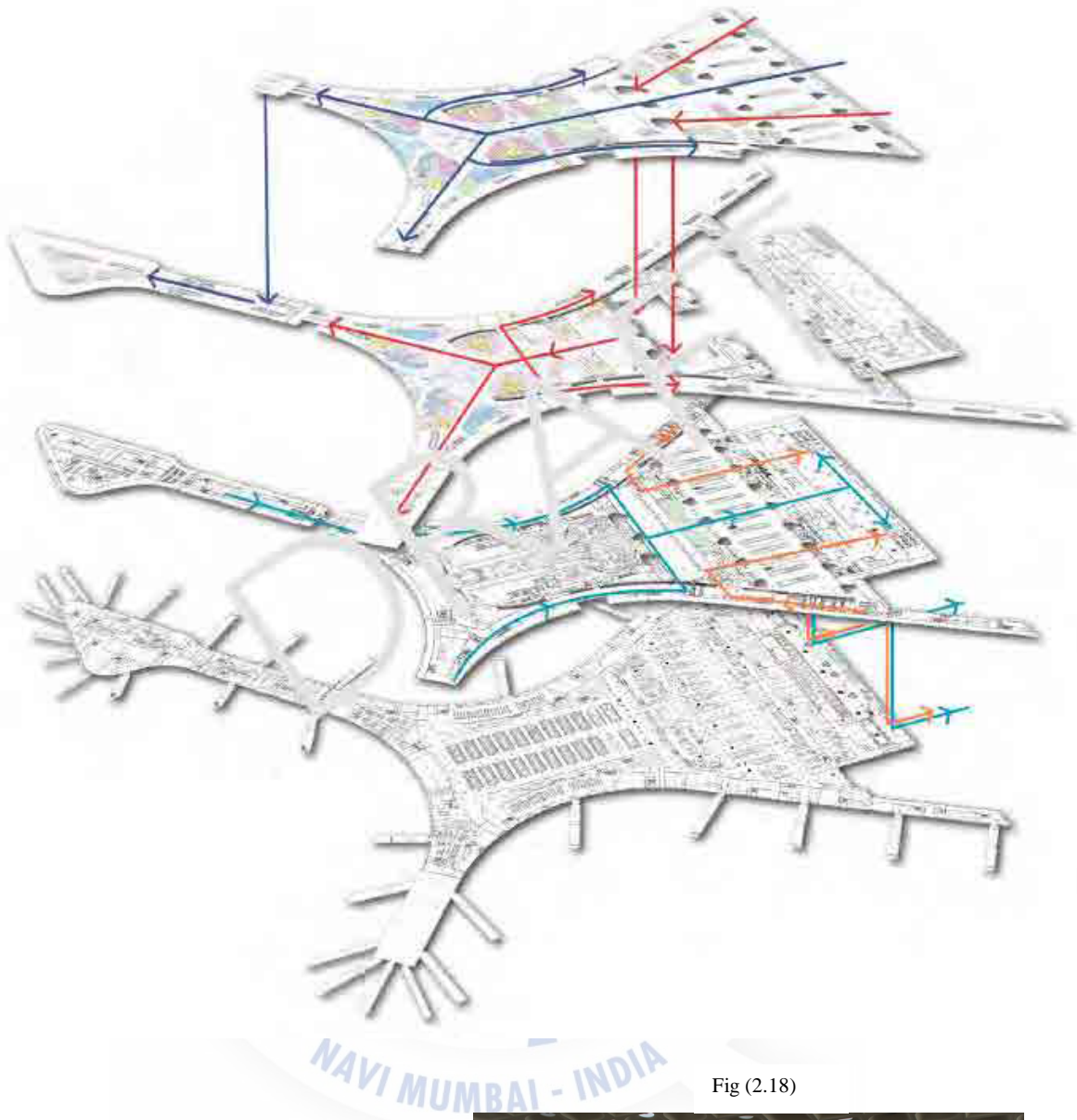


Fig (2.18)

Key

- International Departures
- Domestic Departures
- International Arrivals
- Domestic Arrivals

Optimised passenger flow



For both departing and arriving passengers, simple flows have been planned through the terminal taking passengers through the primary commercial areas on their way to their destination.

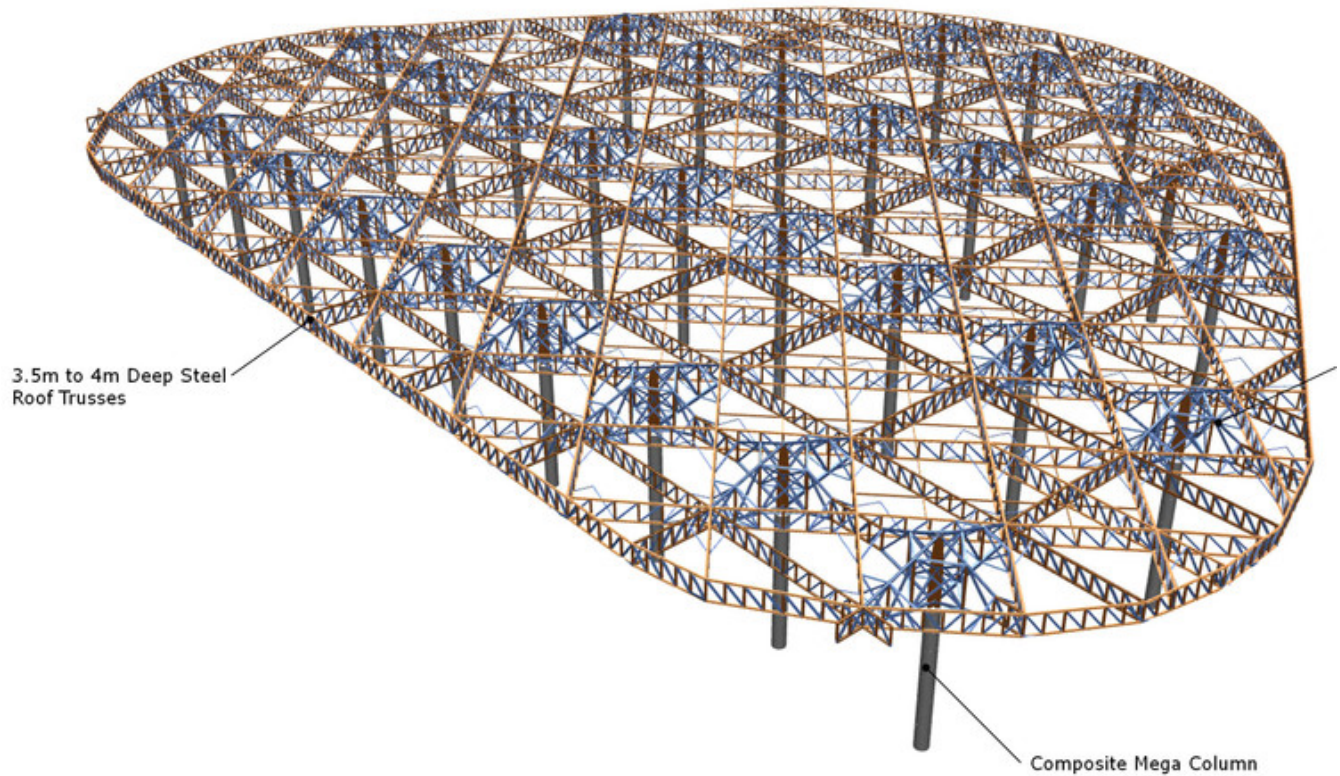
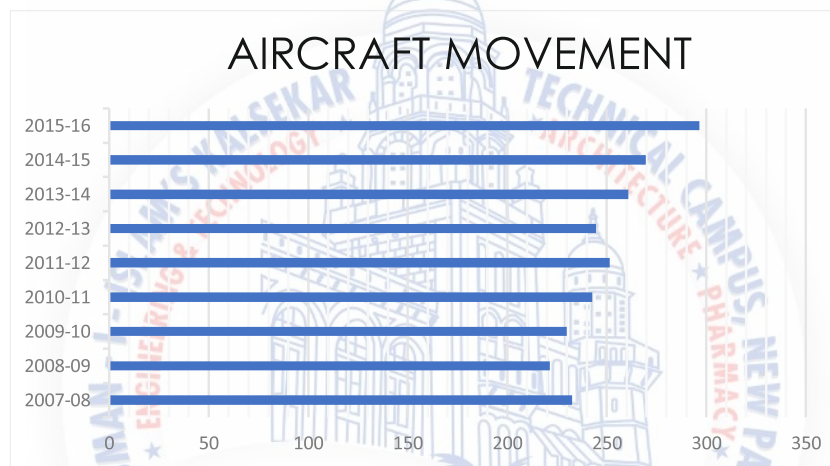
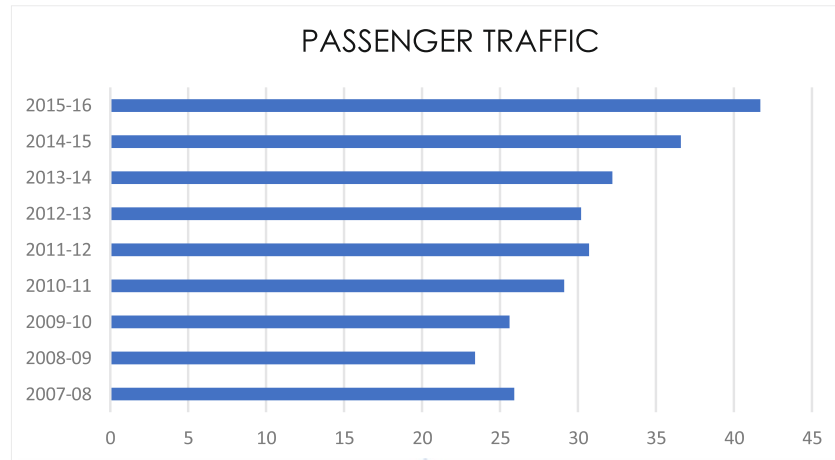


Fig (2.19) The truss Grid

The structural grid

The behaviour of the 40 m tall cantilevered composite mega-columns was studied using analyses for each individual mega-column. The composite mega-columns consist of a built-up steel cruciform shape encased in 2.7 m diameter of concrete for the majority of its height. Once the column reaches the height of the column pod bottom chord connection, it transforms into a bare steel cruciform shape and tapers to the column.



Over a period of time we can see there is an increase in passenger traffic and cargo handled which increases the aircraft movement. It adds on to the air traffic in CSIA.

SWOT Analysis

<p>Strength</p> <ul style="list-style-type: none"> • Being the busiest airport functionally it never faced any problems • Architecturally it gives a strong expression to the people 	<p>Weakness</p> <ul style="list-style-type: none"> • Because of increase in demand the airport has to work over night.
<p>Opportunities</p> <ul style="list-style-type: none"> • As the air traffic is increasing every year the demand for airport is increasing. 	<p>Threat</p> <ul style="list-style-type: none"> • Overnight working of airport may become dangerous in terms of passengers safety.

2. JOLLY GRANT AIRPORT, DEHRADUN.

Project details

Year of construction: 2007

Project architect : Harpal Singh

Site area : 250 Acres

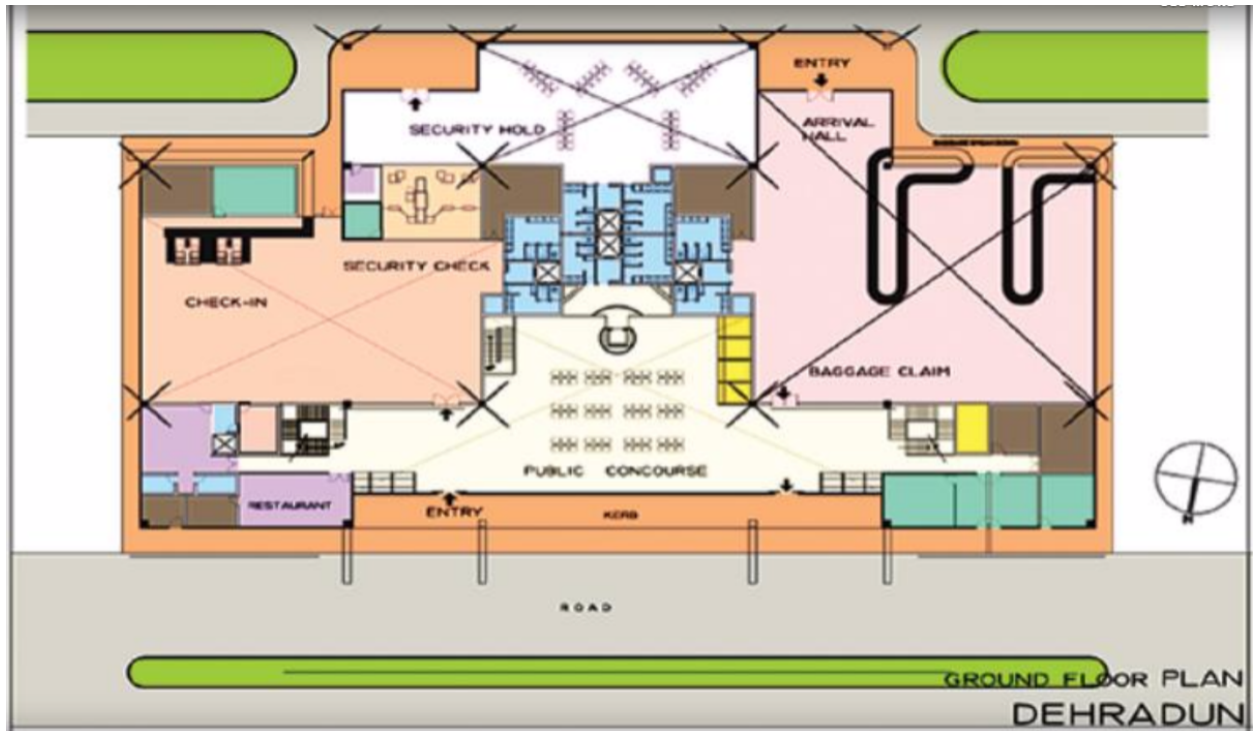
No. of levels : 2

Uttarakhand depends upon tourism- it is the backbone of its economy. The state however has severely limited connectivity. Dehradun airport is the only airport in the Garwal region in Uttarakhand. Dehradun is a prominent tourist destination, with the Shivalik hills, the Himalayas and the rivers Ganga and Yamuna passing through.



Fig(2.19) View of the airport from landside

The Airport occupies a total site area of 250 acres. The size of the runway is 2140 M long and 45 m wide. The new terminal building comprises of an area of 4200 sq.m. The building has been updated with the most modern facilities, with a peak hour capacity of 150 passengers. The annual handling capacity is close to 1.22 lacs. Dehradun airport was capable of handling usually small aircrafts. Being upgraded by AAI it was later capable of landing bigger aircrafts.



Fig(2.20) Ground floor Plan

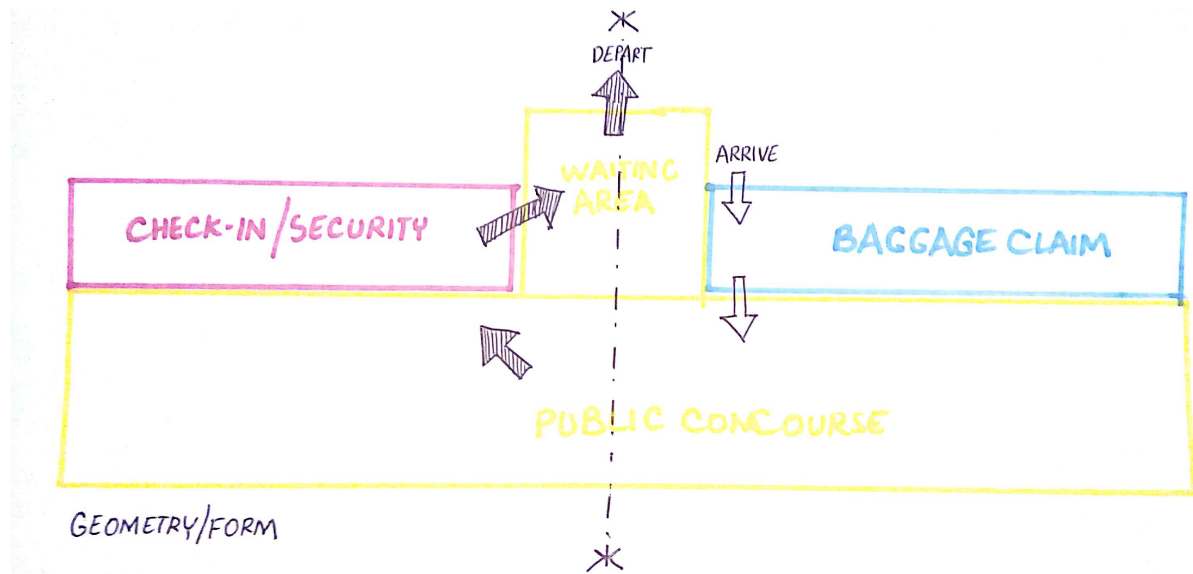
The massive steel and glass building with exposed structural framework and a maximum span of 24M which allows an open plan concept, it acquired a vibrant character as the glass envelope reflects the landscape imagery, and visually opens up the interiors towards the exterior.

The roof had translucent sky lights covering 5% of total roof area to provide natural light to main concourse, check in and baggage claim area thus reducing the need for artificial lighting. These three spaces are double height spaces.



Fig(2.21) view from the airside

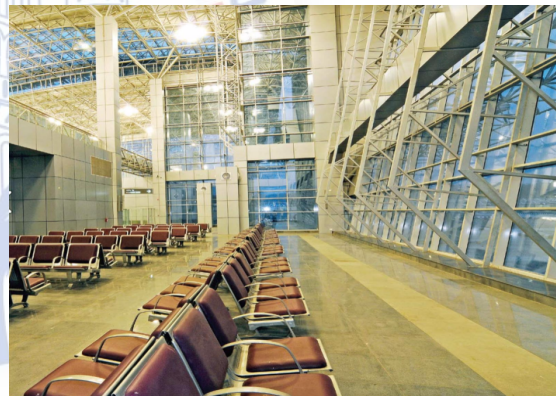
Planning & Geometry



GEOMETRY/FORM

Fig(2.22) Geometry & Form

The architect has tried to achieve symmetry in planning. Large open spaces and longer spans helped in free flowing of the passengers. There were no confusions related to the functional flow.



Fig(2.23) Waiting area

SWOT Analysis

<p>Strength</p> <ul style="list-style-type: none"> • Climate responsive • Larger span spaces 	<p>Weakness</p> <ul style="list-style-type: none"> • No retail spaces
<p>Opportunities</p> <ul style="list-style-type: none"> • As it is the only airport in the Gharwal region it has more commercial value • Retail spaces could be introduced 	<p>Threat</p> <ul style="list-style-type: none"> • Management is not able to handle the rush. So, people prefer going by train.

3. Chennai International Airport, Chennai

Project details

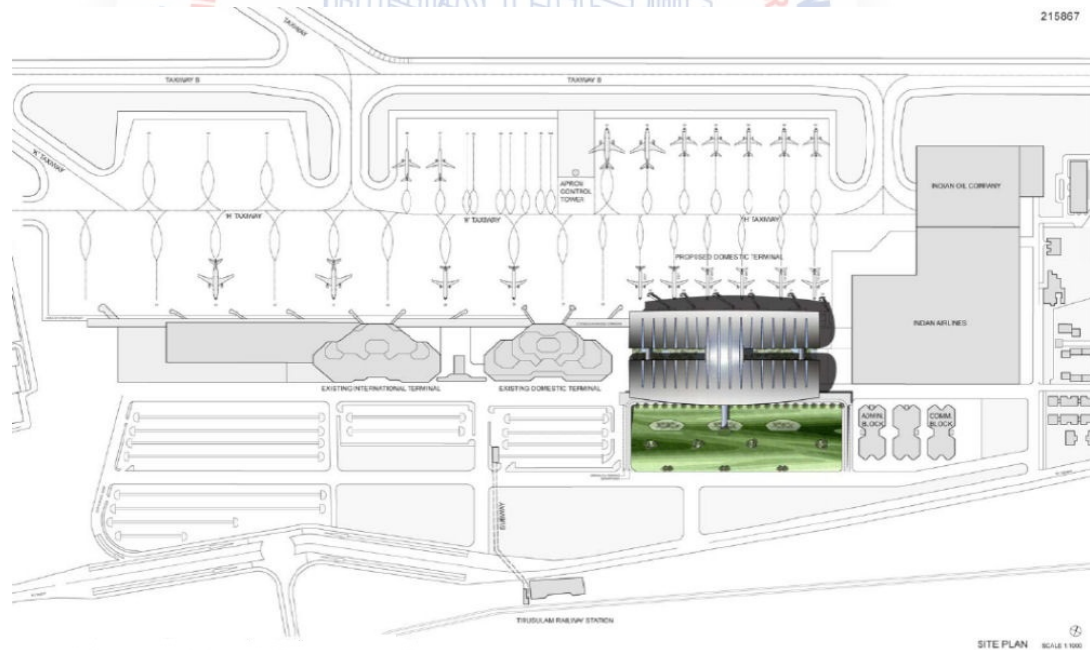
Year of construction: 2012

Project architect : Fedric Schwartz

Site area : 100 Acres

No. of levels : 3

Chennai International Airport serves the south-Indian metropolis of Chennai which becomes a primary airport in this region. In terms of passenger traffic Chennai airport is the 4th busiest airport in India. The passenger terminal building of Chennai airport has 3 levels, a departure area on top floor, ground floor, a basement, and a mezzanine floor. The terminus has an area of 67,700 sqm, with 7 gates, 52 check-in counters and 8 counters for e-ticketing. Capacity of the terminal building is 16 million passengers a year. Peak hour passenger capacity is 3,300 passengers.



Fig(2.24) Site Plan

Key features...

The glass bridge is one of the key feature of Chennai airport. The glass covered walls and ceiling of the bridge opens up to the exterior facing landscape gardens. They tried to follow the concept of inside out. The travellers are even permitted to the garden. The primary use of the garden is to provide with a view for the travellers crossing the bridge.



Fig (2.25) The landscaped area in airport

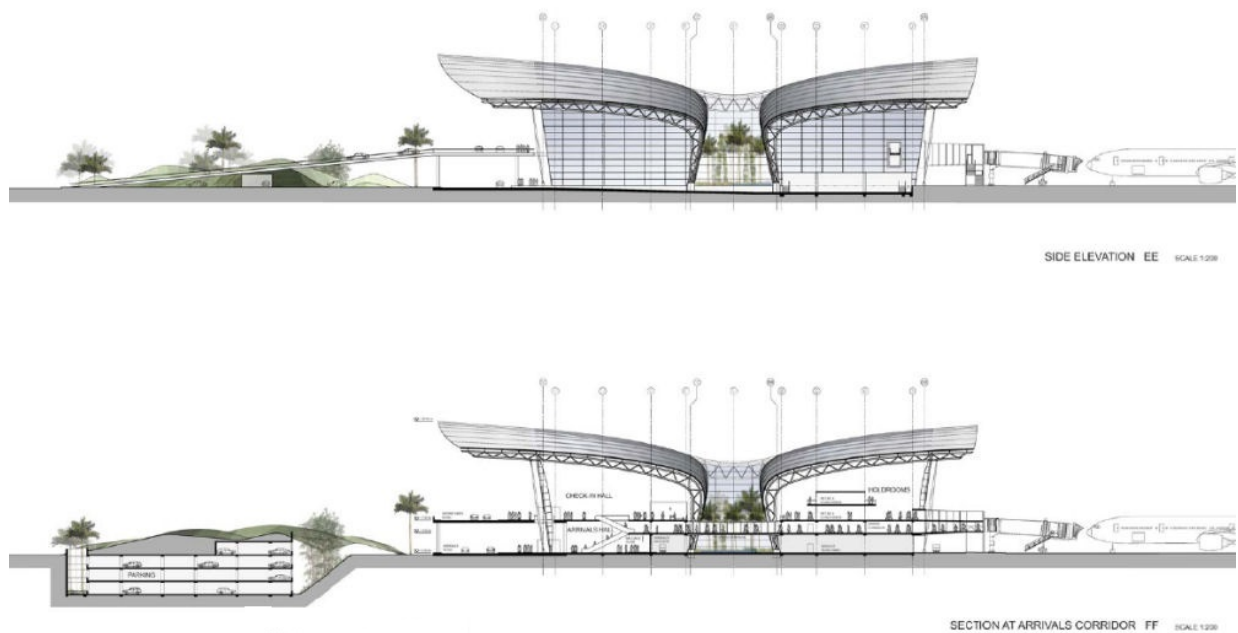


Fig (2.26) Sections and elevations

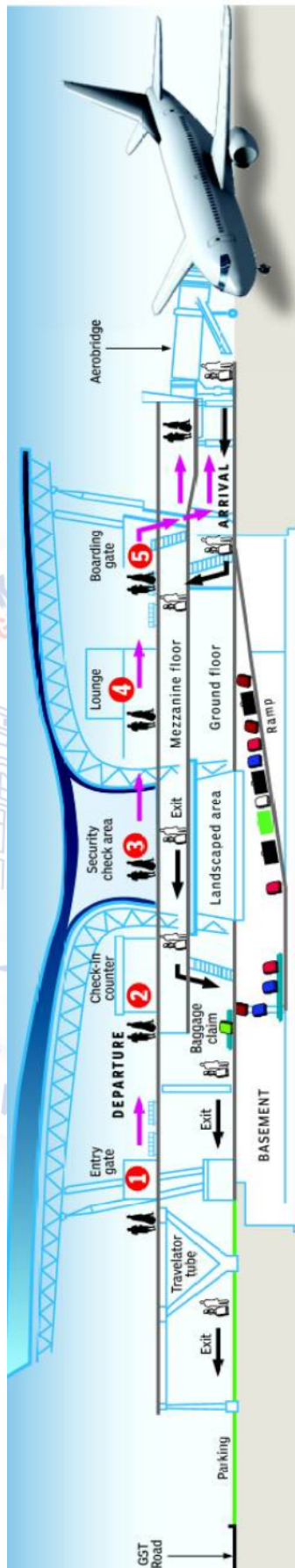


Fig (2.27) schematic sections showing functions of the airport

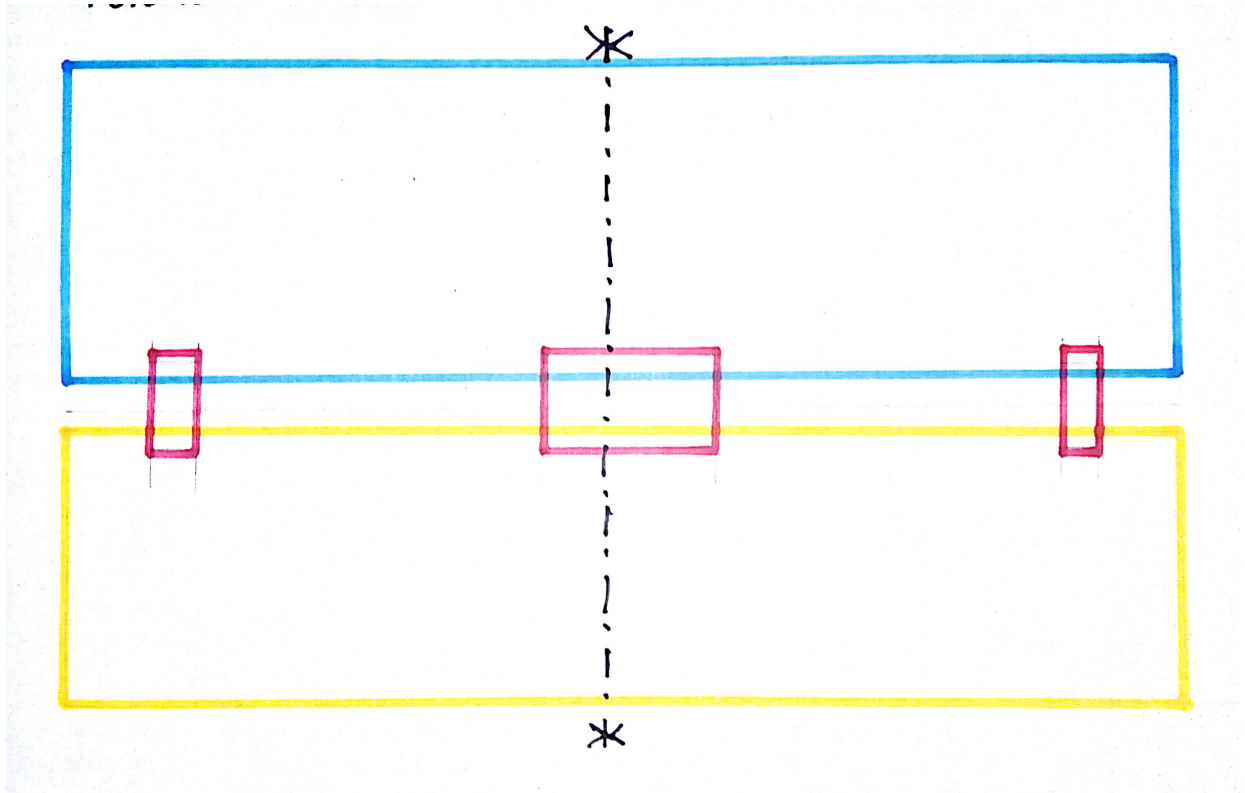


Fig (2.28) Geometry and layout

SWOT Analysis

<p>Strength</p> <ul style="list-style-type: none"> • Gardens • Symmetric planning 	<p>Weakness</p> <ul style="list-style-type: none"> • No adequate seat arrangement for passengers travelling in peak hours
<p>Opportunities</p> <ul style="list-style-type: none"> • Future expansion • Connectivity to the rest of places. 	<p>Threat</p> <ul style="list-style-type: none"> • Frequent accidents inside the terminal building. (falling of curtain glass)

4. TWA Terminal, New York.

Project details

Year of construction: 1962

Project architect : Euro Sarinen

Site area : -

No. of levels : 2

The TWA(Trans Flight Center) was opened in 1962. It was the first terminal to have enclosed jetways for passengers, CCTV, centralized Public address system, Baggage Carousels, Electronic schedule board and baggage scales. Basically, It was the first airport to incorporate all the modern equipment's.



Fig (2.28) View of TWA terminal

The design process

Euro Saarinen came up with the design by making countless study model to determine the most suitable form. The final form which was derived consisted of 3 different configuration of curved, diamond shaped shells supported by 4 massive curvilinear shaped columns.

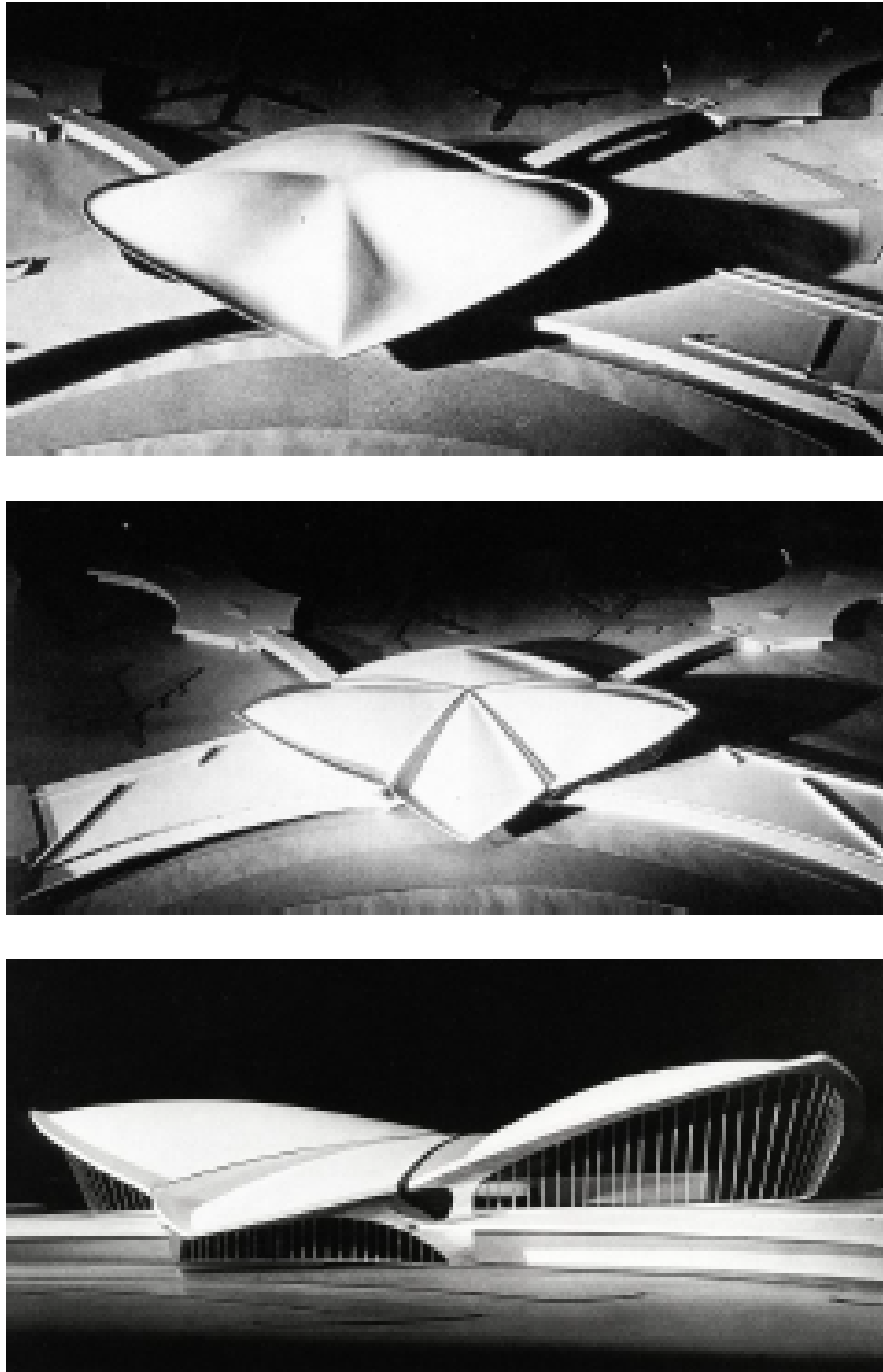


Fig (2.29) Study models

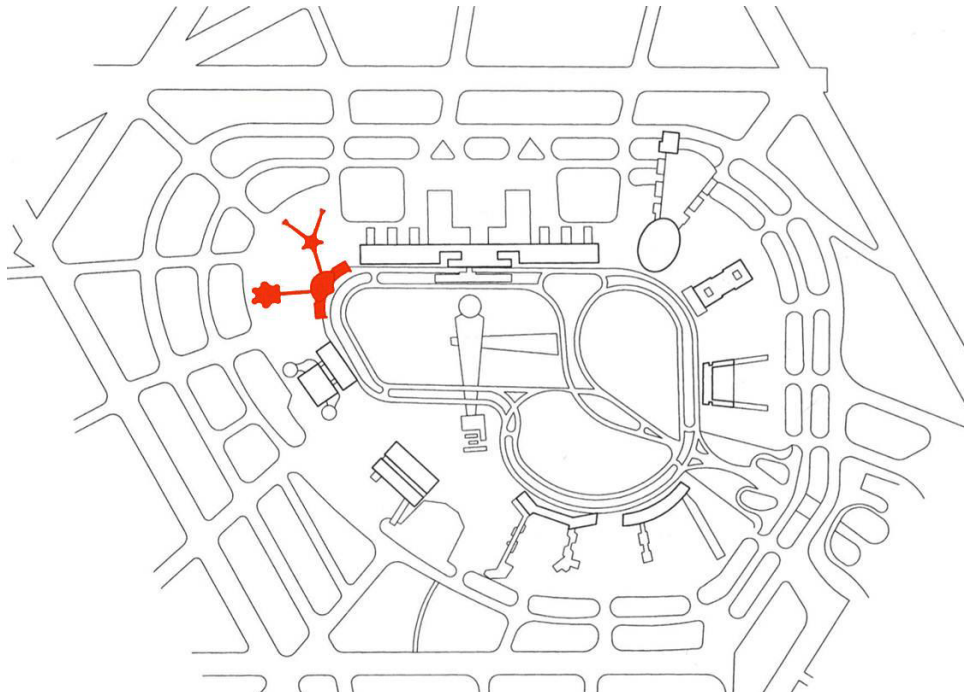


Fig (2.30) Site Plan

1. Information Desk 2. Main Lobby 3. Baggage Claim 4. Ticketing 5. Operations 6. Kitchen 7. Offices

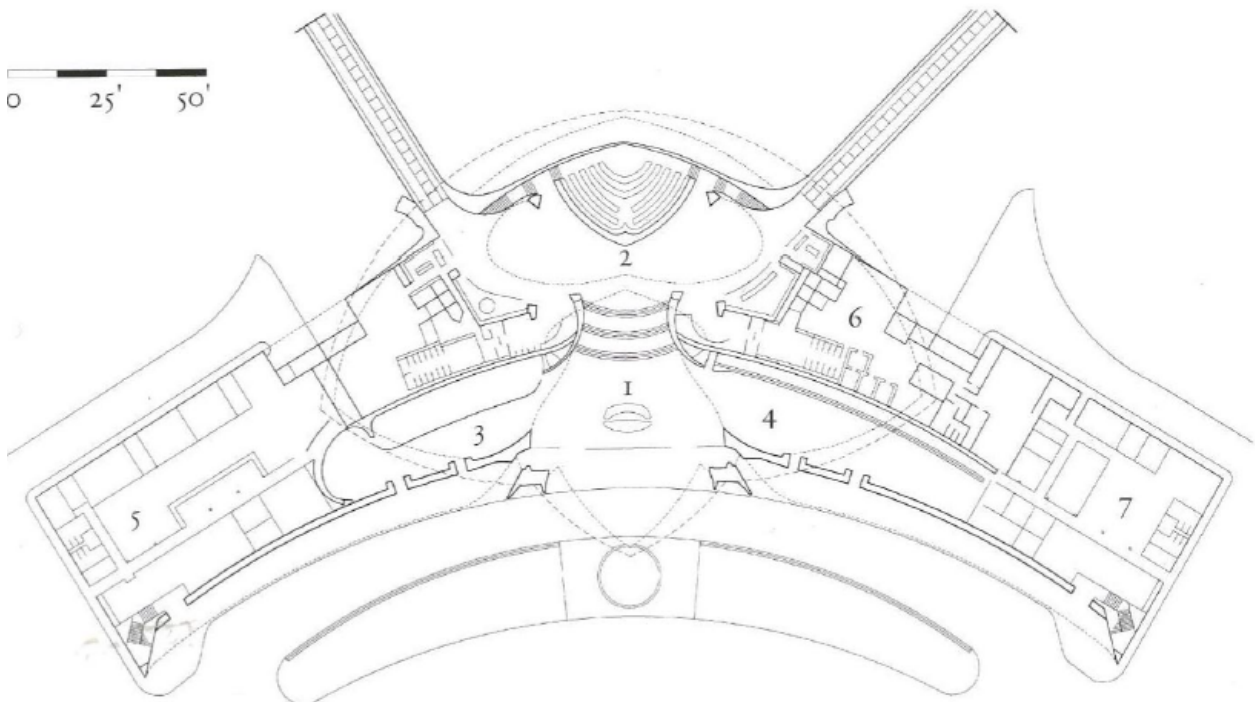


Fig (2.31) Ground Floor Plan

1. Gallery 2. International Lounge 3. Ambassador Club 4. Bar 5. VIP Lounge 6. Service/Kitchen
7. Coffee Shop 8. Dining Area 9. Observation Deck

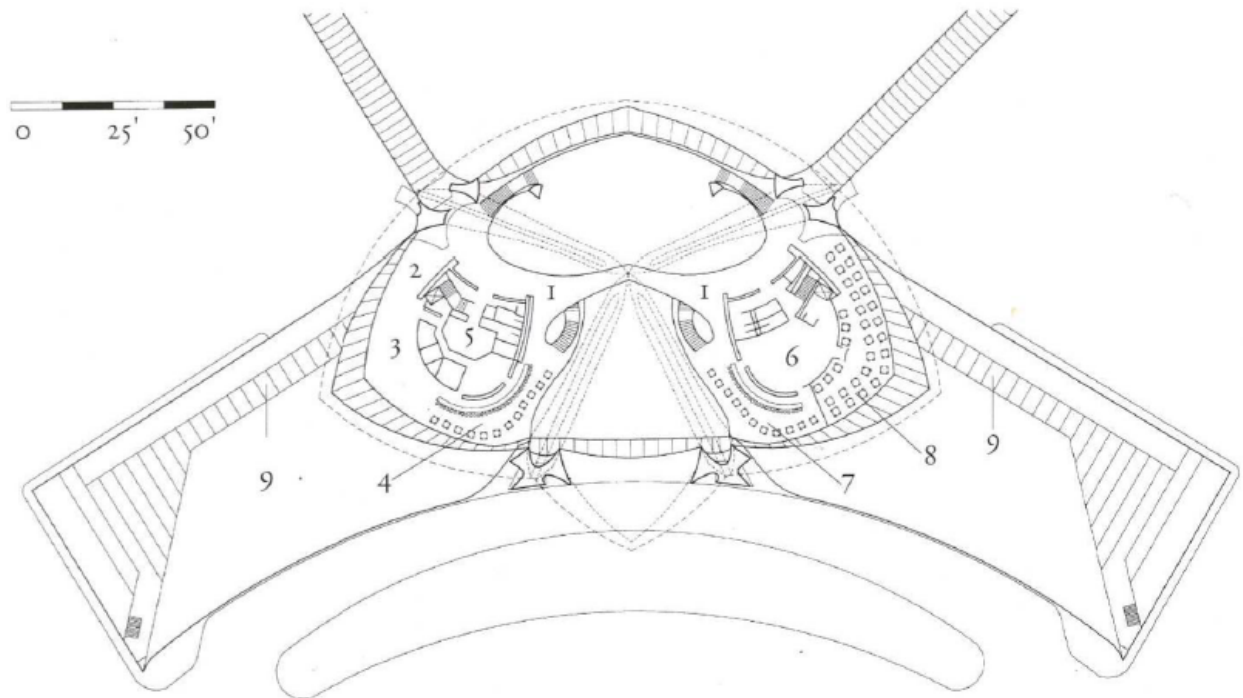


Fig (2.32) First Floor Plan

The shell of the roof was cast in situ RCC shell curve inspired by Grape Fruit. The thickness of the shell ranges from 7" to 40" at columns. The cantilevers extend to 80'. The 4 curvilinear y columns stand as a bold element to the designed which is 51' tall.

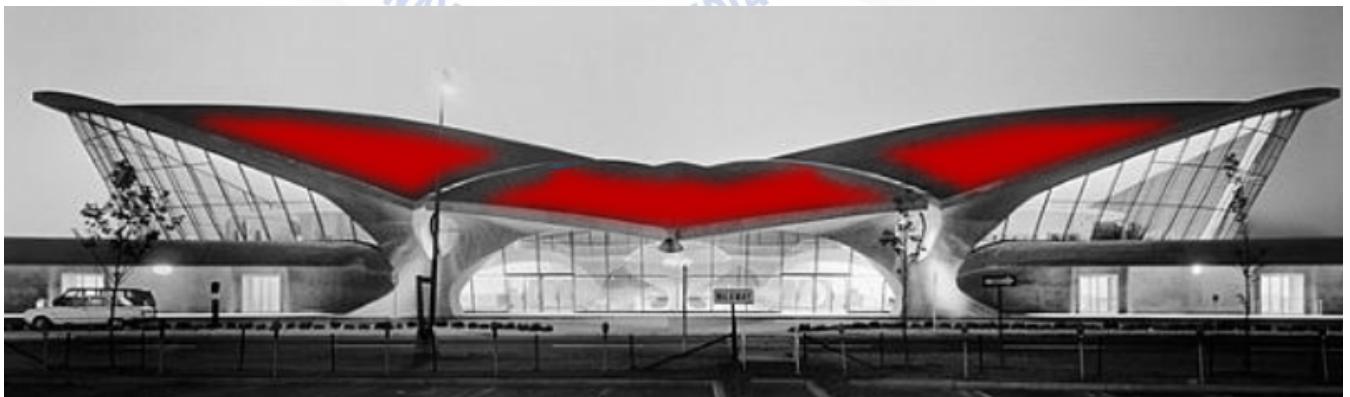


Fig (2.33) front elevation highlighting the shell roof

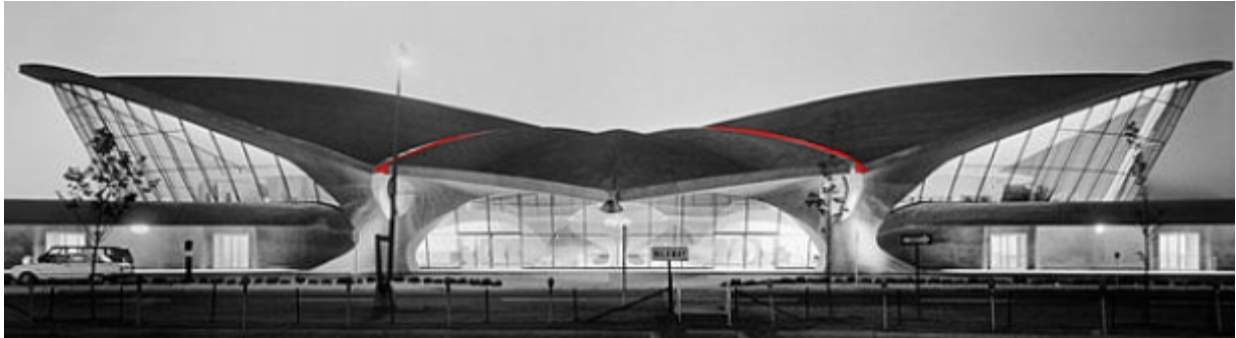


Fig (2.34) front elevation highlighting the sky lights

The sky lights emphasize the line of the roof and separation of the vaults. Each shell meets at the center to support each other. The sky lights stretch across separating the shell.



Fig (2.35) front elevation highlighting the curtain glass

SWOT Analysis

<p>Strength</p> <ul style="list-style-type: none"> • Design element • Form • Architectural language 	<p>Weakness</p> <ul style="list-style-type: none"> • Small spaces • No longer used as an airport terminal
<p>Opportunities</p> <ul style="list-style-type: none"> • Still could be used for smaller functions in airport. • Another option is to turn it into a museum. 	<p>Threat</p> <ul style="list-style-type: none"> • Lack of political will • Ignorance to the architectural language

5.SUARNABHOOMI INTERNATIONAL AIRPORT,BANGKOK.

Project details

Year of construction: 2006

Project architect :MURPHY/JAHN (MJTA group of consultants)

Site area :3100 Ha

No. of levels :3

The passenger terminal of the Swarnabhoomi Airport is the 9th busiest airport in Asia. Suvarnabhumi Airport operates 76 flights an hour on 2 simultaneous parallel runways; it has 51 aircraft stands and 69 remote parking bays for wide bodied aircrafts and handles over 3 M tons of cargo annually.

Some of the important highlights

- 2 parallel runways, each 60m wide , one 3,700m long and the other 4,000m long with a runway separation distance of 2,200m
- Two parallel taxiways to facilitate simultaneous departures and arrivals
- 120 parking bays (51 with contact gates and 69 remote gates) and five of these capable of accommodating the airbus a380
- 132m air traffic control tower which is the tallest in asia
- Two 5-storey parking garages with a capacity for 5,000 cars
- A 190,000m² cargo terminal
- Aircraft maintenance facilities: four fully equipped aircraft hangars to service up to 12 aircraft simultaneously
- Three separate catering facilities to cater for 65,000 airlines meals per day
- landside road system: two two-lane roads inside the airport with a total length of 36km
- Utility system: 40,000m³ water tank; water treatment system for 12,000m³ of water per day; main transformer station for transforming electricity from 115kv to 24kv; eight garbage collection stations; seven telephone exchanges and two main exchanges



Fig (2.36) Suvarnabhoomi Airport

- Electrical railway system: a future extension will swiftly transport passengers to and from central Bangkok
- Hotel with 600 rooms operated by accor group under the novotel brand
- Express freight facilities: one warehouse, one office building and 12 aircraft stands

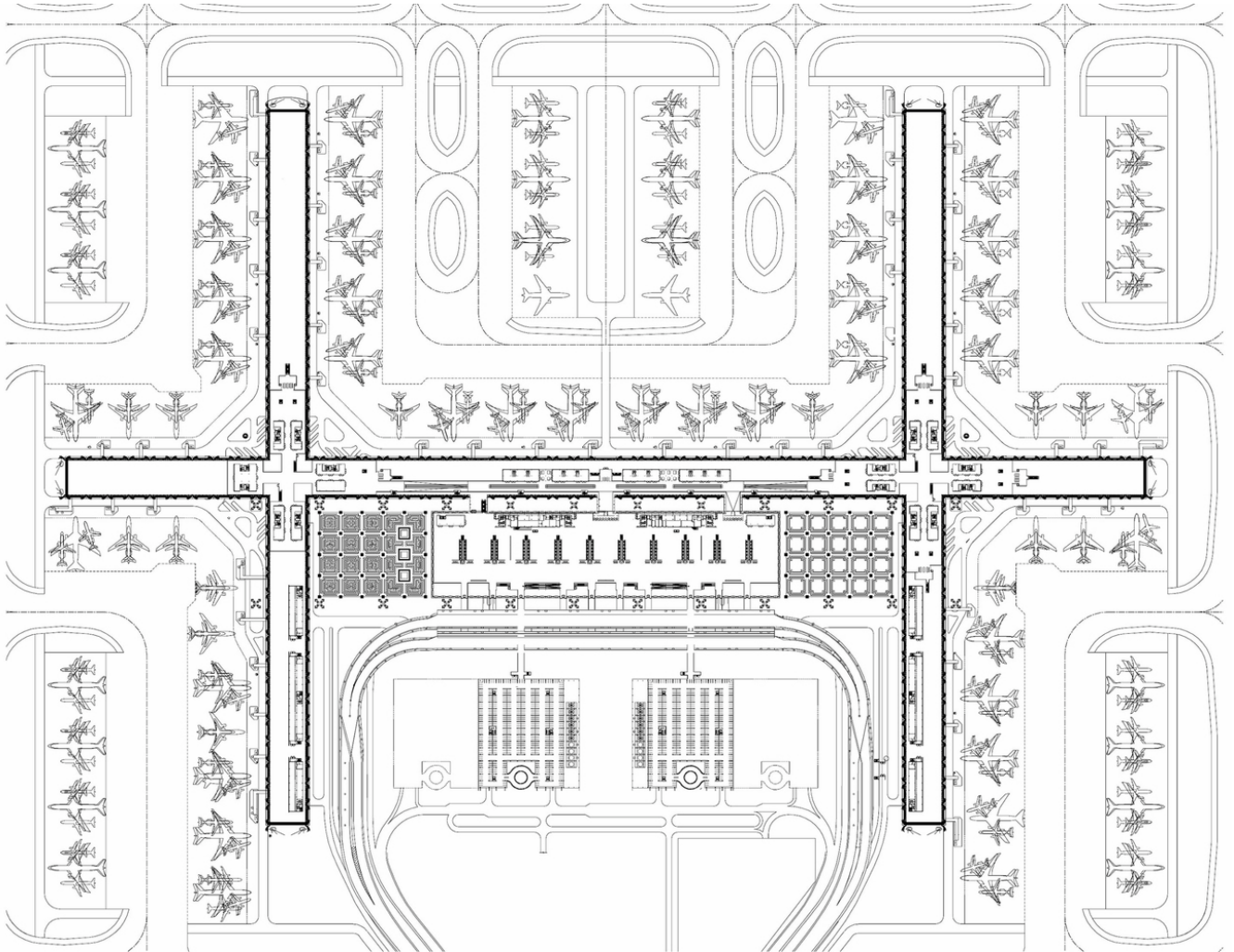
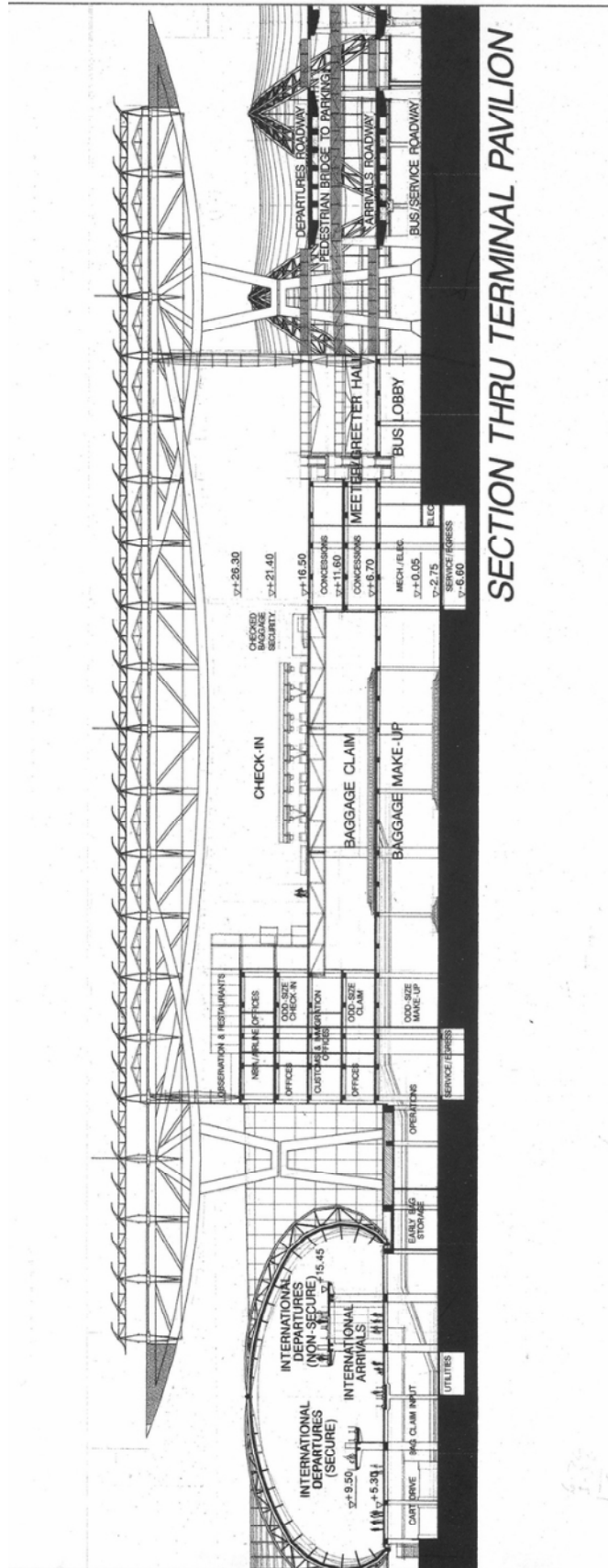


Fig (2.37) Floor Plan Suvarnabhoomi Airport



SECTION THRU TERMINAL PAVILION



Fig (2.38) Section Suvarnabhoomi Airport



Fig (2.39) Landscaped areas in Suvarnabhoomi Airport

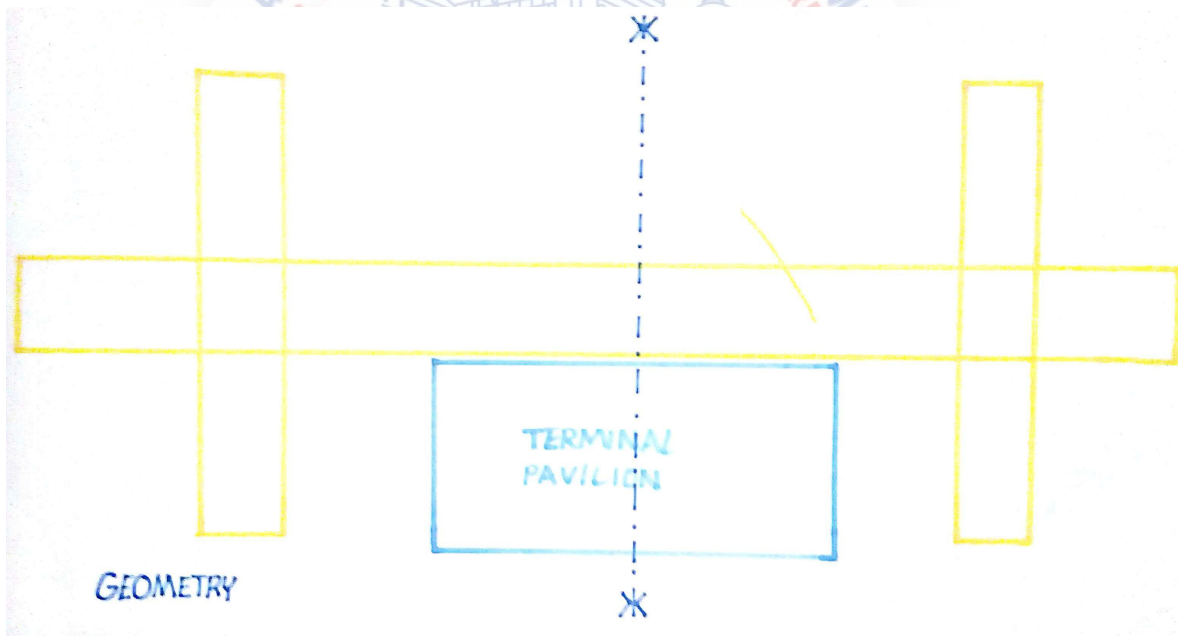


Fig (2.40) Layout and geometry

6. KEMPEGOWDA INTERNATIONAL AIRPORT, BANGALURU.

Project details

Year of construction: 2008

Project architect :SOM Architects

Site area :1600 Ha

No. of levels :3

Bangalore airport has followed following pointers as sustainability measures:

Energy Efficiency

- Use of Day lighting from North Facade glass.
- VFD Operated Chillers for HVAC
- Energy audit conducted in house by Energy Auditors Team.
- Implementation of Green Data Centre.
- Implementation of 100% energy metering system
- Implementation of real time monitoring of Energy through Cloud based technology
- Lighting control through lux level
- Implementation of occupancy & Photoelectric sensors/Timers for lighting in other area

Renewable Energy

- Installation of Solar street Lighting (55Nos)
- Installation of Solar Powered Security Cabins (30 Nos)
- Installation of Solar Water heating system for canteen
- Use of Bio diesel of Vehicle and Equipment.
- 500 KW roof top Solar Power System on Utilities buildings.
- 2.5 MW Solar PV System at Airside
- 600 KW Solar Car Park system
- Purchase of 20 MUs/ annum of Solar Power through open access for Airport operation

Water Management

- Monitoring of Water consumption for entire airport & periodic water audits
- Efficient Rain Water Harvesting system .
- Development of abandoned surface wells .
- Water efficient gadgets .
- Utilization of roof top rain water for potable/non potable purpose.
- Recycling of waste water by in-house STP.
- 100 % utilization of treated water from STP for Landscape, HVAC & Firefighting.
- On line water meter monitoring

Waste Management

- Use of color coded bin concept ensures segregation at source.
- Constructed energy efficient Waste Collection Centre.
- Ensure proper segregation of dry & Wet Waste.
- Waste Management on 3 R Principle- Reduce, Recycle & Reuse.
- Plan to establish the State of art Solid Waste Processing center at Airport.
- Comprehensive waste quantification audit & long term strategy development

Material Conservations & Recycling

- Use of rejected building material for drain pitching and slope stabilization.
- Use of recycled bricks
- Use of milled material for roads/ pathways in the airside.
- Training & Involvement of all involved elements
- Various environmental Management plan to reduce material consumption.
- Automated system to reduce paper consumption.
- Use of recycled paper .
- Use of recycled Tee Shirt and caps during internal sports event.

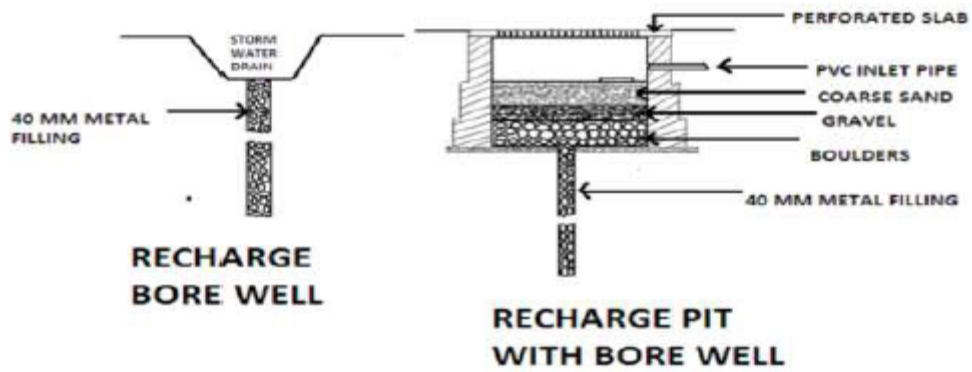
GreenCo Parameters & Weightages Applicable to BIAL

SL No	Parameters	Weightages (Points)
1	Energy Efficiency	150
2	Water Conservation	100
3	Renewable Energy	100
4	GHG Reduction	100
5	Waste Management	100
6	Material Conservation, Recycling & Recyclable	75
7	Green Supply Chain	75
8	Others (Ventilation, Site Selection & Innovation)	100
Total		800

GreenCo Certification Levels & Criteria



Groundwater Enhancement by Constructing 315 Rain Water Recharge Pits



Open type rain water harvesting ponds



USE OF RENEWABLE ENERGY



Renovation and reuse of abandoned open wells as alternate water supply for Emergency. No bore wells are used in BIAL.



2.2.4 Case Study Inferences

Basically airports are characterised into 3 types based on its usage and they are:

1. Regional
2. National
3. International

Regional Airport- The functions in regional airport usually is carried out in a single level as these typology of airport is meant to cater less number of passengers.

National Airport- The functions of a National Airport is usually carried out in 2 levels . these are again categorised into two types- one in which the main entrance concourse for both arrival and departure is in level 1 . And in other typology the main entrance concourse for both arrival and departure is in level 2.

International Airport- The functions of the international airport happens in 3 levels-Level 1 for Baggage, Level 2 for arrivals Level 3for departures.

In addition to these levels some airports give parking level at the basement.

Almost in all cases the architect has tried to follow symmetry in planning. Symmetric planning reduces the confusion for common people. There is a negative side in symmetry which is things tend to repeat because of which people find it difficult to find their ways. Signages plays an important role in airport way finding.

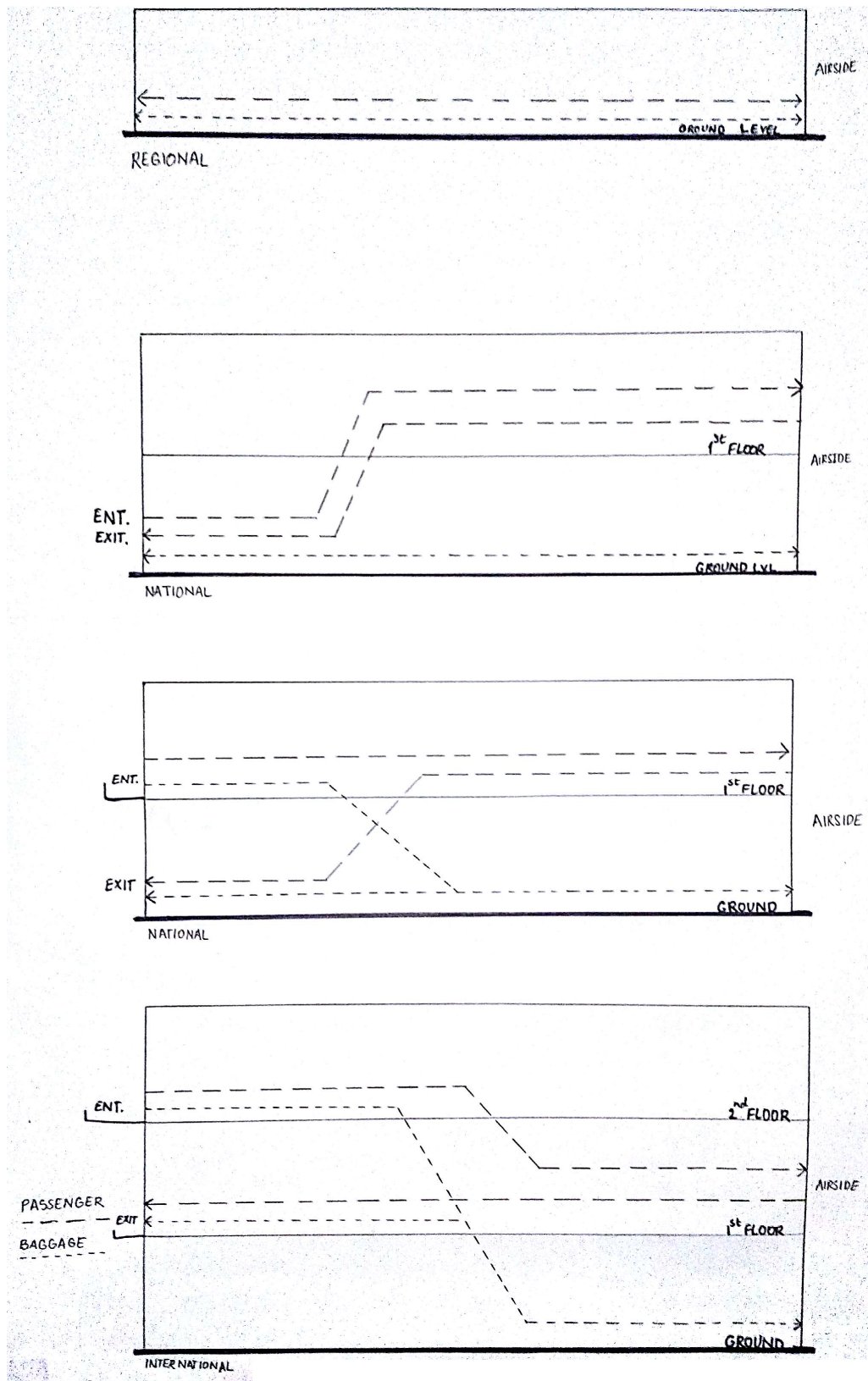


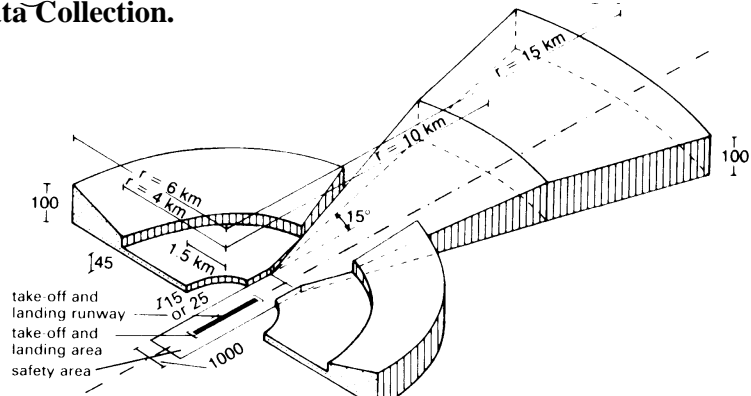
Fig (2.41) schematic section

Comparative analysis of functions in an airport

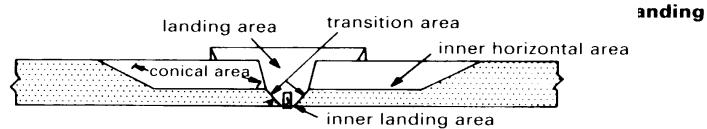
Functions\Airports	CSIA	Jolly Grant	Chennai	TWA	Suvarna Bhoomi
Aircraft Line Maintenance
Airline Lounge
Airport Office
Airport op. control centre
Airside Safety Office
Art Room
Baggage cart Storage
Baggage Handling
Business Centre
Cargo Management
Ceremonial Lounge
Commercial Retail
Commercial Services
Customer Service
Duty Free
Food court
Gate lounge
General Seating
Ground Handling
Lactation Lounge
Left Luggage Room
Lost & Found
Lounge Area
Maintenance Facilities
Medical Station
Offices & Support
Police Station
Porter Services
Prayer Rooms
Public circulation
Public toilet
Safety Management
Security Check
Security Offices
Smoking Lounge
Special Events
Staff Toilets
Telecom Closet
Terminal Management
Tickets Sales area
Transit Hotel

2.3 Research Design

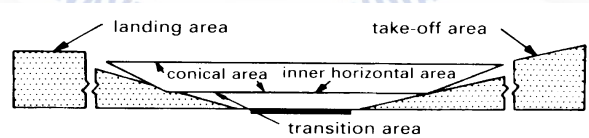
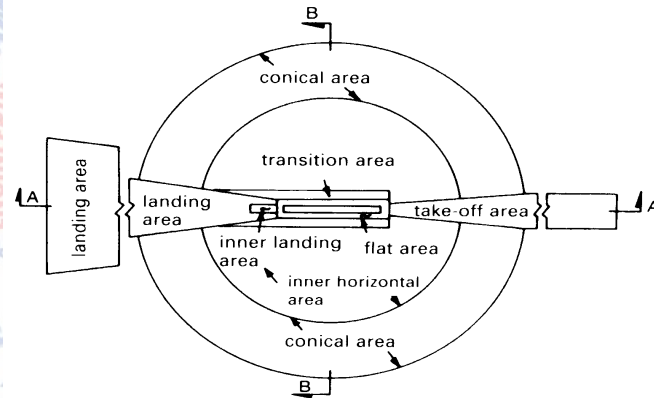
2.3.1 Standards and Data Collection.



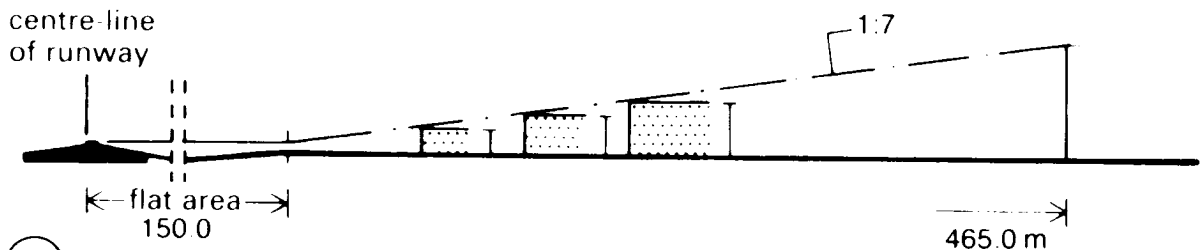
Required obstruction-free area for take-off/landing, longitudinal section (A-A)



Required obstruction-free area for take-off/landing, cross-section (B-B)

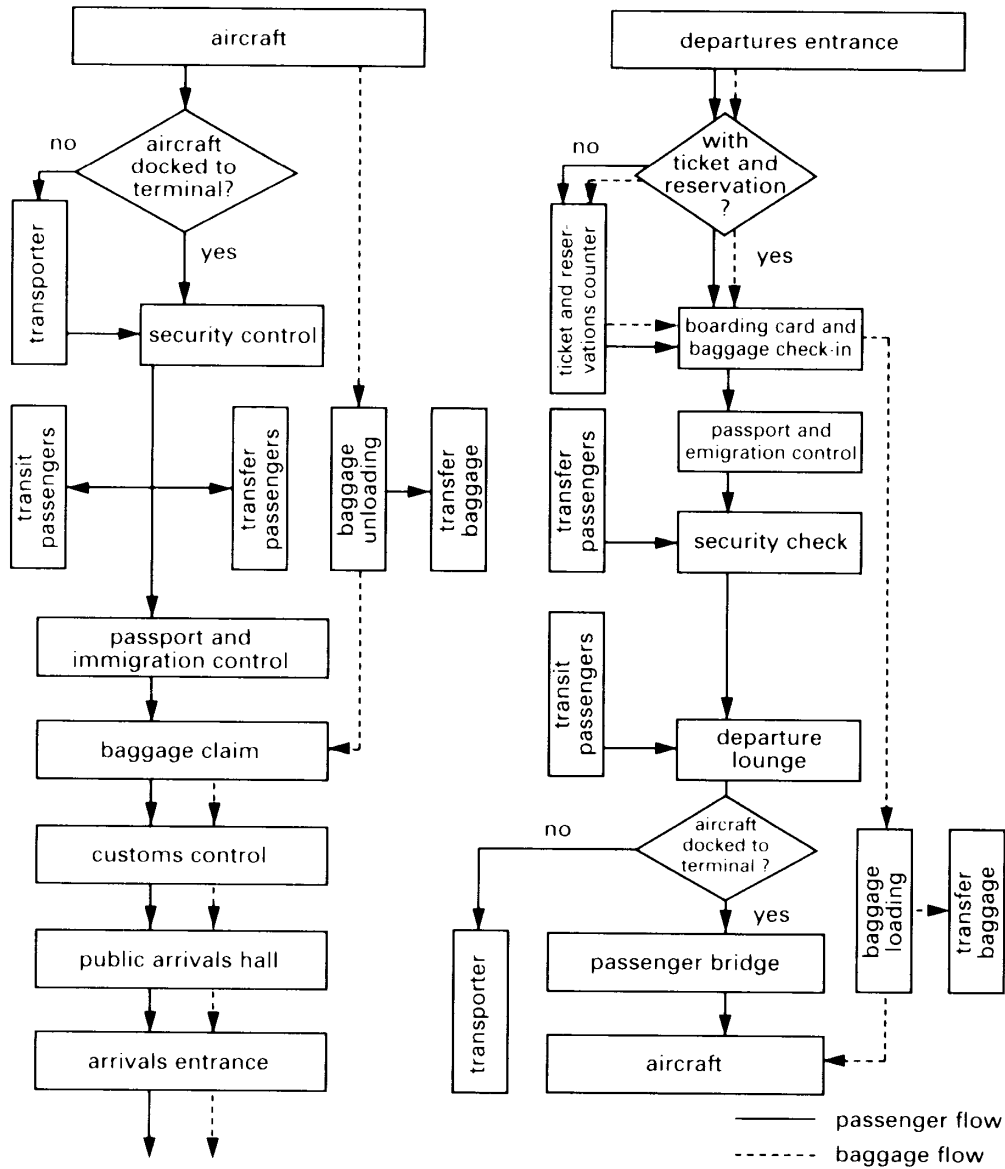


Required obstruction-free area for take-off/landing, longitudinal section (A-A)



4 Permissible building heights immediately beside runways

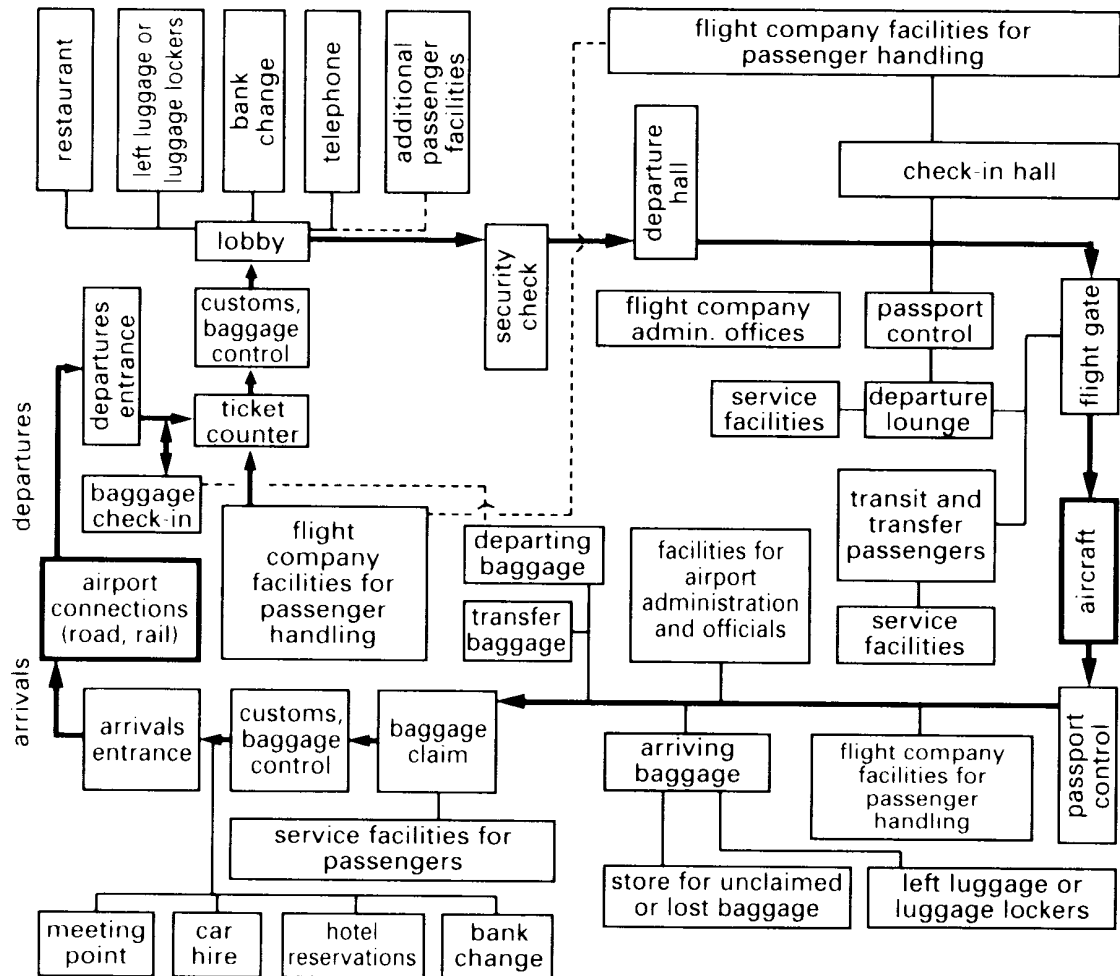
Ref. Neuferts.



① **Passenger arrival flow diagram**

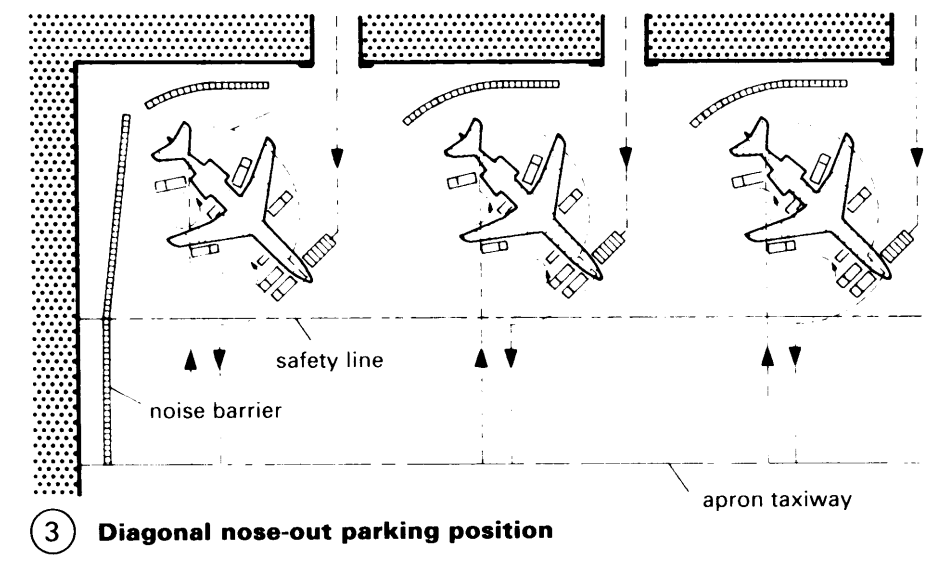
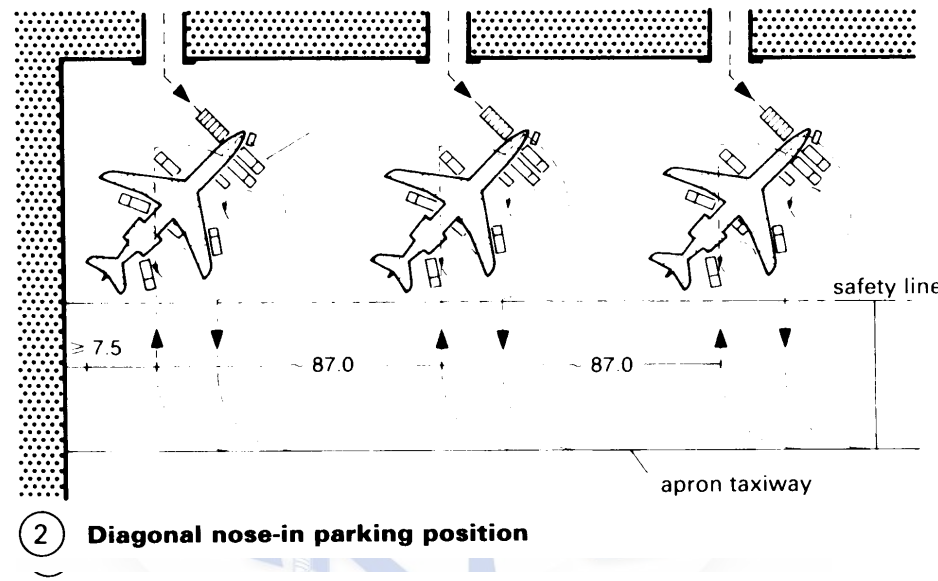
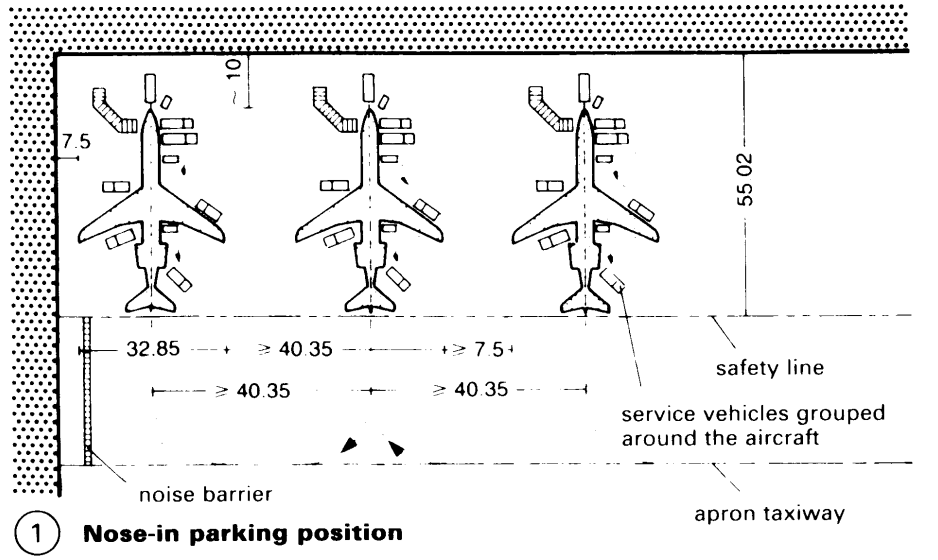
② **Passenger check-in/departure flow diagram**

Ref. Neuferts.

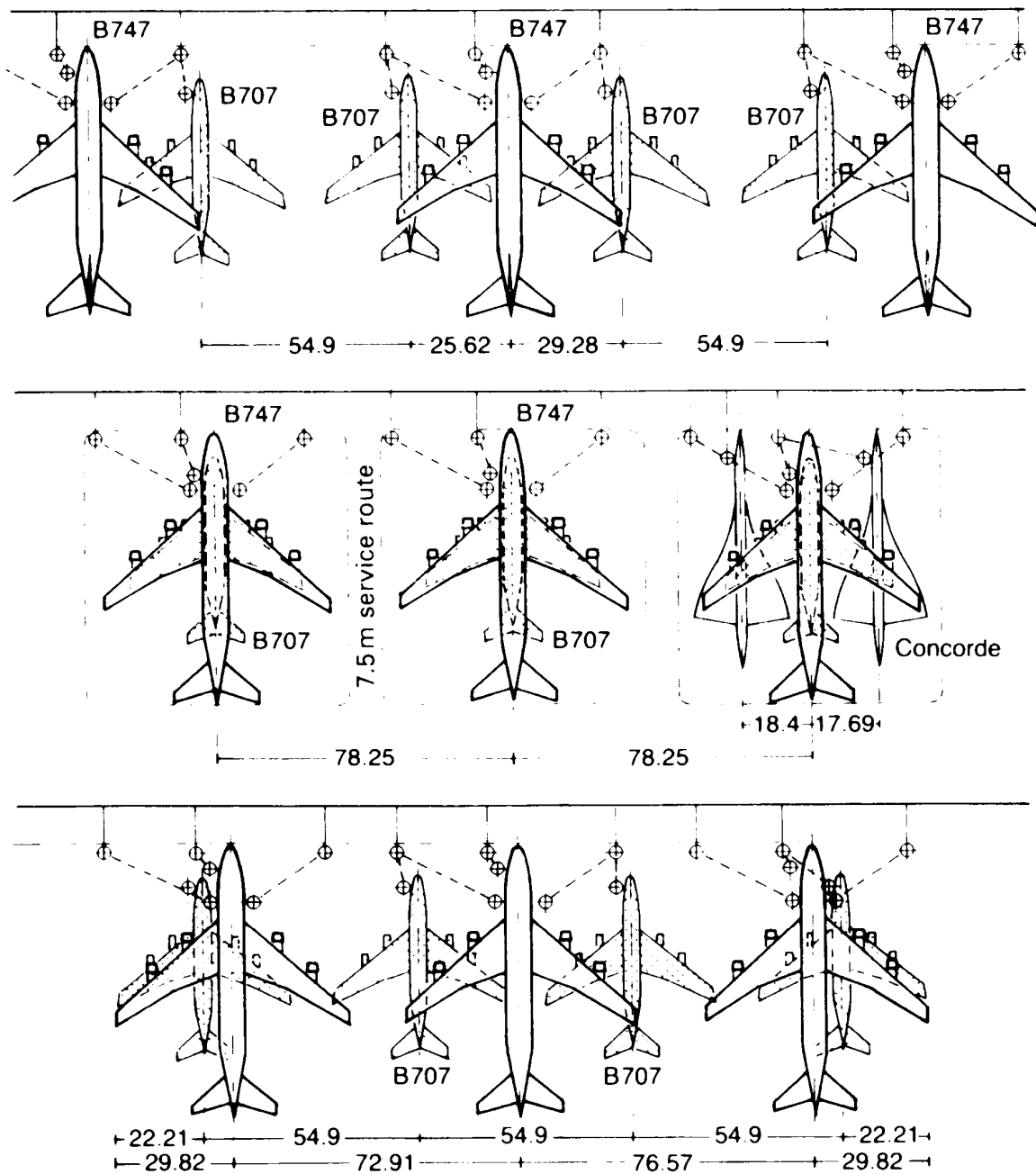


3 Functional diagram of a terminal building

Ref. Neuferts.



Ref. Neuferts.



4 Typical aircraft parking arrangements

Ref. Neuferts.