A dilacerations tank will be provided to allow injection of aircrafts wastes water into the sewage system. The need is for 500 m² in the security area (2014 and 2034), and 1000 m2 for ultimate development.

6.3.6. Cargo area

The forecasts for the Air Cargo Volume are low but not negligible (18 000 tons in 2014 and 64 000 tons in 2034), and appropriate facilities need to be included in the master plan for handling the volume that is expected in the future.

Considering the data of other similar airports, we will use a 5 tons/m² ratio for the cargo terminal and a need for an equivalent area for ULD storage. This ratio takes into account a moderately automated cargo facility and peak activity.

The total necessary area will take into account area for circulation, car parks and deliveries (this does not take into account any aircraft stands) with:

- 10 m service road,
- 35 m deep court for deliveries on each sides of the cargo terminal,
- 50 to 80 m cargo terminal,
- 7 m public access road,
- 20 m deep double row parking lot,
- curbs.

This leads to the following requirements:

Phase	Expected capacity (tons/year)	Cargo terminal area (m²)	Area (m²)
2014	21 095	4 500	22 500
2034	75 813	15 500	62 000

For ultimate development, it is necessary to have a cargo terminal of 21 000 m² and a land area of 84 000m².

6.3.7. Maintenance area

The decision to create an aircraft maintenance center is entirely the responsibility of the airlines. Such facilities are usually, but not always, located on the airport where the aircrafts are based. Therefore, facilities sizing will primarily depend upon the level of maintenance check performed (major or on line maintenance or combination of both) and the size of the based fleet, plus possibly the requirement for third party maintenance services provided to non-based airlines.

Classical on-line maintenance should be performed directly on aircraft stands before any implementation of dedicated area.

We will then take into account the need to reserve the area for 2 wide bodies aircraft bays with apron, appropriate workshops, offices and car park.

For a wide body, the necessary land area for 1 bay is 30 000 m².

The total for the maintenance area is then 60 000 m2 (2034) and 90 000 m2 for ultimate development.

6.3.8. General aviation area

This area includes aircraft hangars, dedicated apron and taxilanes, clubs house buildings…

We use a ratio of 500 m² per aircraft stored during night time.

As Dabolim airport authority mentioned a total of 10 to 12 general aviation aircrafts movements in the peak hour, we will take into account a similar activity. This will lead to 20 aircrafts stored and as such a total area of 10 000 m² and 20 000 m² (2014 and 2034) and 30 000 m2 for ultimate development.

6.3.9. Business aviation area

A business aviation area will be reserved on the master plan.

It will include:

- a business terminal (1 000 m²) with dedicated access road and car park (500 m²),
- a business jet apron for 4 type B (ICAO classification, wingspan < 24 m) aircrafts with autonomous manoeuvres (11 000 m²),
- a business jet hangar for 4 jets (2 500 m²),

for a total area of 15 000 m² (2014 and 2034) and 22 500 m2 for ultimate development.

The business jet terminal will be designed so as to be able to welcome VVIP.

6.3.10. Helicopters area

The helicopter area will be located close to the general aviation area. It will include hangars for 4 helicopters, apron for 4 helicopters, taxi lane and landside access.

We use a ratio of 3 000 m² per helicopter stored during night time for a total of 12 000 m² (2014 and 2034) and 18000 m2 for ultimate development.

Helicopters landing and take-off operations will be handled on the runway.

6.3.11. Airport city

The airport will include a consequent area dedicated to services, hotels and accommodations for passengers and tourists: the Airport City.

Hotel and business center

Without further information, the area will include :

- a business hotel,
- a business offices building and an international conference center,

for a total area of 40 000 m² (2014 and 2034) and 60 000 m2 for ultimate development.

		2034	
Year traffic (MPax)		International pax	Domestic pax
A or D		833 295	2 815 723
A+D		1 666 590	5 631 445
%Int & % Dom.		29%	71%
Peak hour		International pax	Domestic pax
A or D		600	1400
Departure or arrival peak rate		13%	9%
		International terminal	Domestic terminal
Public Hall			
Departure passengers occupancy time	15 minutes		
Arriving passengers occupancy time	5 minutes		
Minimum depth	6 m		
	Surface	598 m²	1 395 m²
Information desks in public area			
Positions	2 positions		
Width	1,5 m		
Depth	3 m		
Depth in front of position	2 m		
	Surface	30 m²	30 m²
Check-in			
Width	2,1 m		
Depth without collector	3 m		
Depth in front of check-in	12 m		
Circulation	6 m		
Number of positions		20	37
	Surface	882 m²	1 632 m²
Emigration			
Width	1,7 m		
Depth	2,4 m		
Depth in front of emigration desks	15 m		
Number of positions		11	
	Surface	325 m²	0 m²
Security			
Width	3,5 m		
Depth	11 m		
Depth in front of security desks	12 m		
Number of staff security positions (35 m²)			1
Number of passengers security positions		3	6
	Surface	242 m²	518 m²
Boarding areas			
Load factor	90% des sièges max		
Simultaneity factor	75% des pax dans la salle		
Seats offer	85% des pax présents		
Synergy factor	85% des surfaces de sièges		
Circulation width		3,5 m	3,5 m et 5 m
Departure Control System Wide Body area	100 m²		
Departure Control System Narrow Body area	50 m²		
	Surface	5 873 m²	7 778 m²
Bagage sort			
Collector conveyor (2,5 m width room)		105 m²	194 m²
Luggage control area		300 m²	600 m²
Baggage sorting equipment		1 000 m²	2 000 m²
	Surface	1 405 m²	2 794 m²

Commercial area			
Retail-service, duty free shops + minor réserves		800 m²	800 m²
Reserves near pier in public area		200 m²	200 m²
Commercial desks in ZP		240 m²	240 m²
	Surface	1 240 m²	1 240 m²
Immigration			
Width	1,7 m		
Depth	2,4 m		
Depth in front of immigration desks	20 m		
Number of positions		11	
	Surface	419 m²	0 m²
Baggage claim			
Wide Body units		3	1
Narrow Body units		1	7
Customs		2	
	Surface	2 900 m²	4 300 m²
Services			
Infirmary		30 m²	30 m²
Lavatories in public hall (men and women)		7	17
Lavatories (men and women)		11	18
Lavatories in boarding lounge (men and women)		21	37
Marketing services, advertising		167 m²	282 m²
	Surface	509 m²	888 m²
Employees offices and facilities in public area and security area			
Back offices			
Changing room			
Lavatories & showers			
Reserves			
Offices, assembly rooms			
	Surface	2 500 m²	5 447 m²
Delivery pier (common)			
Trucks positions			8
Pier width	5 m		
Ramps			4
	Surface (50%/50%)	445 m²	445 m²
Technical areas			
Ratio	12% of gross area		
	Surface	3 055 m²	5 200 m²
SUP (useful surface programme)		20 432 m²	34 668 m²
Circulation & architecture			
Ratio	25% of SUP		
	Surface	5 108 m²	8 667 m²
	Gross area	25 540 m²	43 334 m²
TOTAL		68 875 m²	

Table 6.2 : 2nd phase (2034) Terminal Building Program (2 tables)

Ultimate			
Year traffic (MPax)		International pax	Domestic pax
A or D		1 141 808	3 858 193
A+D		2 283 615	7 716 386
Split % Dom.		23%	77%
Peak hour			
A or D		International pax	Domestic pax
Departure or arrival peak rate		800	2200
		15%	10%
		International terminal	Domestic terminal
Public Hall			
Departure passengers occupancy time	15 minutes		
Arriving passengers occupancy time	5 minutes		
Minimum depth	6 m		
	Surface	797 m²	2 193 m²
Information desks in public area			
Positions	2 positions		
Width	1,5 m		
Depth	3 m		
Depth in front of position	2 m		
	Surface	30 m²	45 m²
Check-in			
Width	2,1 m		
Depth without collector	3 m		
Depth in front of check-in	12 m		
Circulation	6 m		
Number of positions		27	58
	Surface	1 191 m²	2 558 m²
Emigration			
Width	1,7 m		
Depth	2,4 m		
Depth in front of emigration desks	15 m		
Number of positions		15	
	Surface	444 m²	0 m²
Security			
Width	3,5 m		
Depth	11 m		
Depth in front of security desks	12 m		
Number of staff security positions (35 m²)		4	1
Number of passengers security positions			10
	Surface	322 m²	840 m²
Boarding areas			
Load factor	90% des sièges max		
Simultaneity factor	75% des pax dans la salle		
Seats offer	85% des pax présents		
Synergy factor	85% des surfaces de sièges		
Circulation width		3,5 m	3,5 m et 5 m
Departure Control System Wide Body area	100 m²		
Departure Control System Narrow Body area	50 m²		
	Surface	8 230 m²	10 847 m²
Bagage sort			
Collector conveyor (2,5 m width room)		142 m²	305 m²
Luggage control area		450 m²	750 m²
Baggage sorting equipment		1 500 m²	2 500 m²
	Surface	2 092 m²	3 555 m²

Commercial area			
Bar/self-service, duty free shops + minor réserves		800 m²	800 m²
Reserves near pier in public area		200 m²	200 m²
Commercial desks in ZP		240 m²	240 m²
	Surface	1 240 m²	1 240 m²
Immigration			
Width	1,7 m		
Depth	2,4 m		
Depth in front of immigration desks	20 m		
Number of positions		14	
	Surface	533 m²	0 m²
Baggage claim			
Wide Body units		3	2
Narrow Body units		2	9
Customs		3	
	Surface	3 400 m²	6 100 m²
Services			
Infirmary		30 m²	30 m²
Lavatories in public hall (man and women)		10	26
Lavatories (men and women)		14	29
Lavatories in boarding lounge (men and women)		28	59
Marketing services, advertising		229 m²	385 m²
	Surface	575 m²	1 320 m²
Employees offices and facilities in public area and security area			
Back offices			
Changing room			
Lavatories & showers			
Reserves			
Offices, assembly rooms			
	Surface	3 425 m²	11 575 m²
Delivery pier (common)			
Trucks positions		12	
Pier width	5 m		
Ramps		6	
	Surface (50%/50%)	668 m²	668 m²
Technical areas			
Ratio	12% of gross area		
	Surface	4 067 m²	7 225 m²
SUP (useful surface programme)		27 114 m²	48 164 m²
Circulation & architecture			
Ratio	25% of SUP		
	Surface	6 778 m²	12 041 m²
	Gross area	33 892 m²	60 205 m²
TOTAL		94 097 m²	

Table 6.3 : Ultimate Phase Terminal Building Program (2 tables)

6.2.2.2. Functional Concept

The proposed concept is to combine the domestic and international terminals into one single terminal.

It is a "one and one half level" passenger terminal.

The landside curbside is doubled. The closest curbside to the terminal is protected by a wide overhang roof. This curbside is reserved for hotel coaches and taxis, and should remain free of congestion. The secondary curbside for private vehicles, undoubtedly more congested is located in front of the car park. The service access road for the terminal is at the centre of this second curbside, which keeps the ends free for future extensions.

The length of the landside façade provides the initial access to the international terminal.
The first 12 metre depth of the public hall is for both passenger and general public. The departures/arrivals hall is restricted by means of air ticket checking for travelling passengers and is only 5 metres deep enough to allow access to the passenger services: tickets sales, hotel reservations, vehicle hire etc.
This hall is in the form of an "airlock" and is used to access the check-in area. This check-in area could be extended using the baggage retrieval area that can be pushed further to the exterior when the building is extended.
The check-in hall is 20 metres deep with approximately 12 metres of queuing space. After passing through the check-in area, passengers reach the "Immigration Control" zone with 20 metres of queuing space and the passenger screening area, baggage being screened downstream from check-in.
After these security checks, one reaches the departures level at + 5.00 m via a glazed gallery sloping downwards following the line of the gardens (patios) in the form of successive terraces.
On reaching the upper level passengers find themselves in an area of shops, bars etc with interspersed boarding areas. In the future it will be possible to install a travelator from this duty free zone leading to the future boarding area which will be able to handle four wide-body aircraft.
At the junction of the international terminal building with the domestic terminal, flexible partitioning should allow boarding lounges, air bridges and apron stands to be occupied in an optimum manner. The increase of required area for international boarding is related to the increase of the Arrival or Departure peak hour (as stated during Draft Final Report presentation). This additional area should be taken within the buffer zone which was previously mainly dedicated to domestic boarding. The Consultant suggests to keep this flexibility in boarding area allocation by the mean of light mobile partitioning.
On arrival, the passengers from both halls are directed towards a staircase and an escalator leading to an arrivals gallery (in order to keep the arrival/departure flows separate at a distance of at least 8.5 metres. This arrivals gallery descends to the baggage retrieval on the ground floor.

The duty free zone opens onto the large central garden - which could be shared with the domestic terminal – where sales kiosks and bars with terraces are located.

The domestic terminal has almost the same symmetrical design as the international terminal. The Domestic and International Zones are separated in the central patio by a glazed partition. The same applies to the check-in zone.

In the central area of the public hall this separation is achieved with a mezzanine restaurant and bar, which benefits from a terrace providing a view on the central patio and the departing passengers.

In addition to the dynamic signage visible from the halls, airport information centres with public access are located beneath the mezzanine.

In the basement beneath the central area is a delivery platform with lifts leading to the terminal shopping areas.

The transfer between international arrival and domestic departure or domestic arrival and international departure for passengers must be done though public halls .
Due to small number of expected transiting passengers, the consultant believes that it is not cost effective to implant specific immigration, customs facilities and links between international BHS and domestic BHS
Thus, the passenger will be asked to collect his luggage at the carrousel, before entering the public hall. He will then proceed to normal check-in, boarding…

6.2.2.3. Architectural concept

The proposed design is economical and rapid to construct. A large, curving roof slopes down on the runway side to reduce the size of the façade glazing, which will be a horizontal slit, 1.4 metres in height and at 0.6 metres from the ground.

This offers optimum viewing for the passengers, with the supporting structure of the roof be set back from the façade to avoid any break in this continuous horizontal window.

In terms of air-conditioning, the small glazing area is very cost-effective and affords good protection from the glare of the sun reflected onto the concrete. This facility will be economic to maintain, and offers a horizontal panoramic view, emphasised by the undulating lines of the building.

Conversely, on the patio side, the façade is very tall and could incorporate glass and stone arches to reflect Goa's colonial architectural heritage. This façade looking out onto a garden will be lighter, with no reflection on the concrete, but with fountains and trees to shield it, this will in the same time providing a pleasant view for arriving and departing passengers. The arrivals gallery runs the length of this facade.

The large enveloping roof is lower at its central part, below which are located the patio and departures garden. It also drops down at each end, allowing two small patios designed with the same reference to regional architecture.

Landside, the roof drops down to + 8.00 metres, which restricts the height of the glass façade, protected by the wide overhang of this roof which will cover a major part of the road leading to the terminals.

6.2.2.4. Materials

The foundations and floors are of reinforced concrete. The covering is supported by a light metallic structure – a 10 x 20 metre framework with trellis-form beams.

The roof system will be a double-skin system of standing seam aluminium sheets for the roof and aluminium liner panels perforated for the ceiling, with thermal and acoustic insulation sandwich between.

Indirect lighting with a cathedral effect will be provided, the maximum height of the building being less than 20 metres.

The horizontal slit window on the runway side will be double-glazed, without vertical bars.

The landside façade will be single-glazed since the 5 metre deep departures/arrivals halls, effectively acting as a double façade and "airlock", will be air-conditioned and set to the median between the inside and outside temperatures.

Half of the patio façade will be solid and clad in stone with arches inspired by local architecture and the other half in double-glazing.

6.2.2.5. Specific systems

Airbridges

The use of passenger loading bridges to connect the aircraft directly with the terminal building or airside contributes markedly to passenger convenience and comfort. For high volume operations, the use of loading bridges greatly increases the efficiency in processing large passenger loads, reduces the requirement for mobile ground equipment, and decreases aircraft stand occupancy time.

Installation of loading bridges must however be economically justified based upon traffic requirements at each airport. Additional criteria which may differ widely from airport to airport also must be taken into consideration, i.e. extreme weather conditions, airline operating requirements etc…
To reach 70% aircraft connected through airbridges (contact stands), 8 airbridges are required for 11 planes.

Baggage Handling System (BHS)

The Baggage Handling System (BHS) is an airport facility that forms the interface between the airline company's takeover of passengers' baggage at registration or its return to passengers in the baggage claim area, and the aircraft baggage hold loading/unloading operations. It ensures that the baggage of passengers between connecting flights is properly routed between aircraft.
Its purpose is not only to sort the baggage and if required store it, but also to perform security checks before loading into the aircraft hold.

In addition to performing an operating function for the airline company, the BHS constitutes a strategic facility for improving the quality of service to passengers, reducing transit times, and coping with the increasing capacity of aircraft in the years to come.The International BHS and the Domestic BHS are separated.

In order to achieve the optimal utilization of facilities and provide an attractive level of services to the passenger, airports have been adopting sophisticated electronic systems that allow airport operators, airlines and governmental services to manage efficiently the airport facilities, lowering the operation costs and providing better assistance to the passenger and airport users such as airlines, handling agents, …

Other systems

- IT systems
- Ultra-low current airport special systems (ULCASS)
- Building System (BS)

- IT systems
  - Flight Management System (FMS) including Integration System (IS)
  - Management Information System (MIS)
  - Flight Information Display System (FIDS)
  - Baggage Information Display System (BIDS)
  - Resource Management System (RMS)
  - Common Use Terminal Equipment System (CUTE)
  - Common use self service (CUSS)
  - Baggage Reconciliation System (BRS)

- Ultra-low current airport special systems (ULCASS) :
  - Close Circuit Television System (CCTV)
  - Security Access Control System (SACS)
  - Building and Disembarking Route Management System (BDRMS)
  - Public address system (PAS) / voice evacuation system (PA/VA)

IT Systems:

- **Flight Information Display System (FIDS) & Baggage Information Display System (BIDS)**

FIDS is used to provide passengers with information on flights, and FIDS monitors dispatched throughout the terminal building.

The information is transmitted to the public via public television receivers or display boards in local languages or/and in English. These screens may present a list of flights (general screens) or be associated with a given resource (check-in desk, boarding lounge, and baggage claim carroussel).

FIDS is also used for displaying information for hostesses, police, customs, airlines and airport manager.

This system is the first answer to the needs of passenger information.

- **Common use terminal equipment system (CUTE)**

In an airport, the use of check in counters and gates has to be optimized so that every counter or gate will be available for every Airline to access their own Departure Control System (DCS).

CUTE system allows airport to provide good level of service to client airlines and handling agents.

Airlines can take advantage of shared facilities and offer access to the enhanced functionality of their own reservation system.

- **and Common Use Self Service (CUSS)**

The basic idea of the Common Use Self Service (CUSS) concept is to enable airlines to provide passenger check-in facilities at a shared kiosk.

These kiosks can be installed on the way of the passenger from car park, curbside, check-in hall, boarding lounge.

- **Resource Management system (RMS)**

The increase in air traffic requires airport manager to increase resource efficiency. That means to be able to plan and optimize the allocation of the airport's resources as soon as the IATA schedules are published

- **Baggage Reconciliation System (BRS)**

The Baggage Reconciliation system is useful to trace the baggage in the airport, from the moment of its reception at the check-in desk up to the moment of its load into an aircraft.

The BRS is able to locate exactly the position of the baggage.

This improves the security of bag loading and decreases the searching time in case of unloading baggage. The BRS provides a real-time reconciliation between passenger and baggage.

<u>Ultra-Low current airport special systems:</u>

- **Close Circuit Television (CCTV)**

Such a system can meet the requirements of security, police, and customs, operating thanks to the following functions:

- Fixed or mobile cameras, normal or fish eye, ...
- Shooting public zones, aircraft stands, queues, sensitive gates, baggage claim,...
- Video monitors for the police, the customs, the airline, the airport operator, ...

- **Security and Access Control System (SACS & BDRMS)**

Such a system can meet the requirements thanks to the following functions:

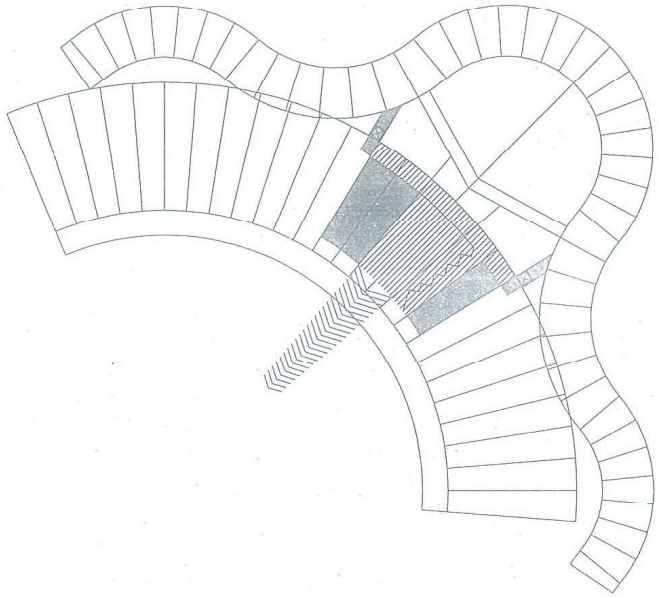
- Monitoring of doors (accesses located on the security, police or customs border, doors of control rooms, offices, ...) or facilities through an automatic detection of irregular opening, intrusion, burglary,
- Workstations, for the staffs of security, police, customs in order to enable them to monitor the tightness of their borders.
- Doors management for boarding and disembarking procedures.
- mobile equipment for computer control of badges validity for security, police, customs,
- Detection of equipment theft: workstations, servers, ...
- Access control through badges and / or biometrics and / or pin code with management of
- Access rights and zones, for gates or check points,
- Workstations to adjust the parameters of access rights, zones, gates.

- **Public Address System (PAS)**

Such a system will allow to broadcast announcements :

- General instructions : security, safety, evacuation messages,...
- Announcements for check-in, boarding ; transfers either automatic or not, in several languages,
- Announcements in case of exceptional events.

NEW GOA INTERNATIONAL AIRPORT



LEVEL -6.00

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- INTERNATIONAL PUBLIC HALL / CIRCULATION
- INTERNATIONAL ARRIVAL
- DOMESTIC DEPARTURE
- DOMESTIC PUBLIC HALL / CIRCULATION
- DOMESTIC ARRIVAL
- INTERNATIONAL / DOMESTIC DEPARTURE
- INTERNATIONAL / DOMESTIC ARRIVAL
- OFFICES AND TECHNICAL ROOM
- SHOPS / RESTAURANT / DUTY FREE
- GARDEN
- RESERVE AIRCRAFT STANDS

THE NUMBER OF AIR BRIDGES IS DEFINED SO AS TO HAVE 70% OF AIRCRAFT AT CONTACT STANDS DURING PEAK HOURS

0 20 40 60 80 100

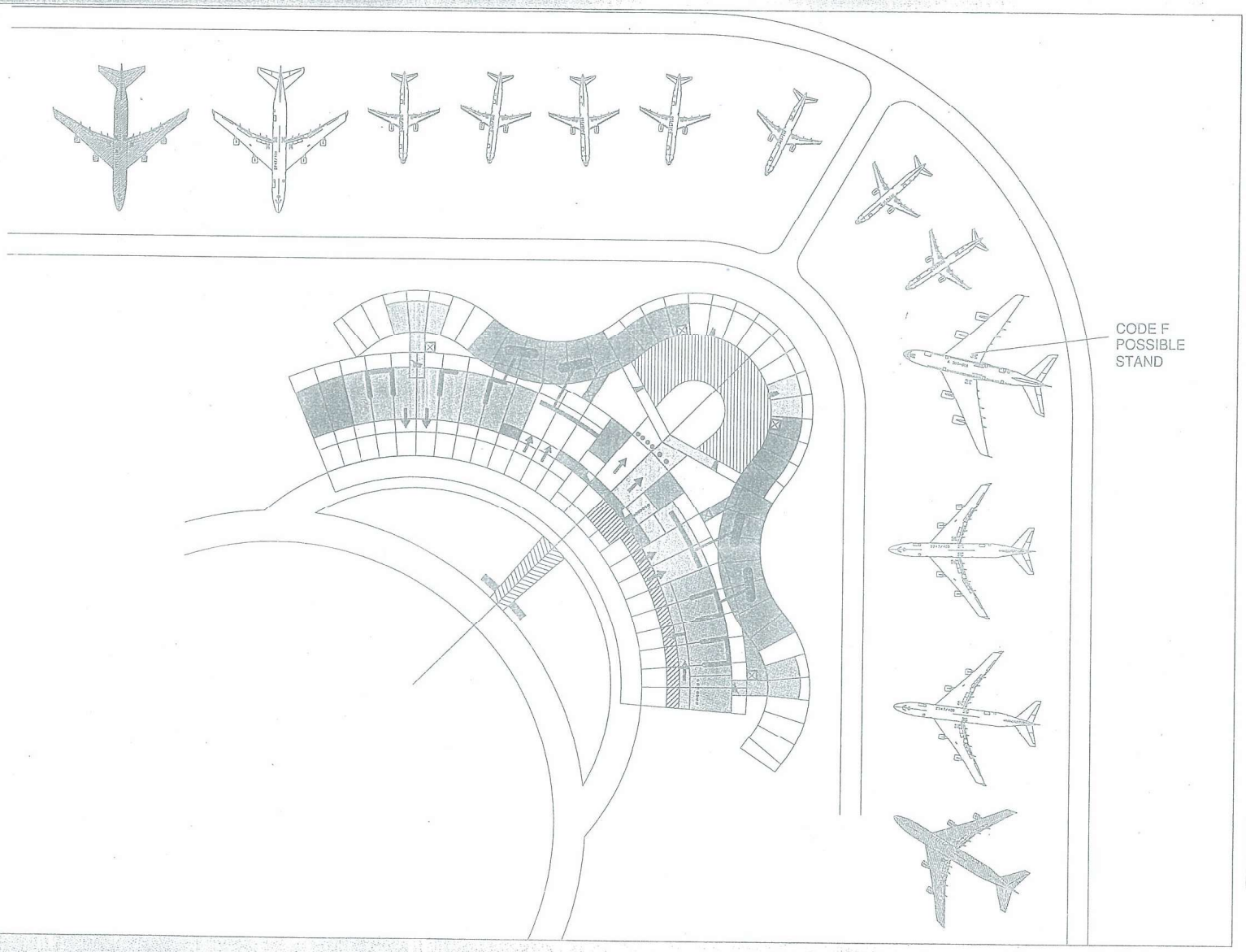
Scale :1/2000e

Date: August 2005

FEASIBILITY STUDY - ZONING PLAN LEVEL - 6.00

ADPi

NEW GOA INTERNATIONAL AIRPORT



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- INTERNATIONAL PUBLIC HALL / CIRCULATION
- INTERNATIONAL ARRIVAL
- DOMESTIC DEPARTURE
- DOMESTIC PUBLIC HALL / CIRCULATION
- DOMESTIC ARRIVAL
- INTERNATIONAL / DOMESTIC DEPARTURE
- INTERNATIONAL / DOMESTIC ARRIVAL
- OFFICES AND TECHNICAL ROOM
- SHOPS / RESTAURANT / DUTY FREE
- GARDEN
- RESERVE AIRCRAFT STANDS

THE NUMBER OF AIR BRIDGES IS DEFINED SO AS TO HAVE 70% OF AIRCRAFT AT CONTACT STANDS DURING PEAK HOURS

0 20 40 60 80 100

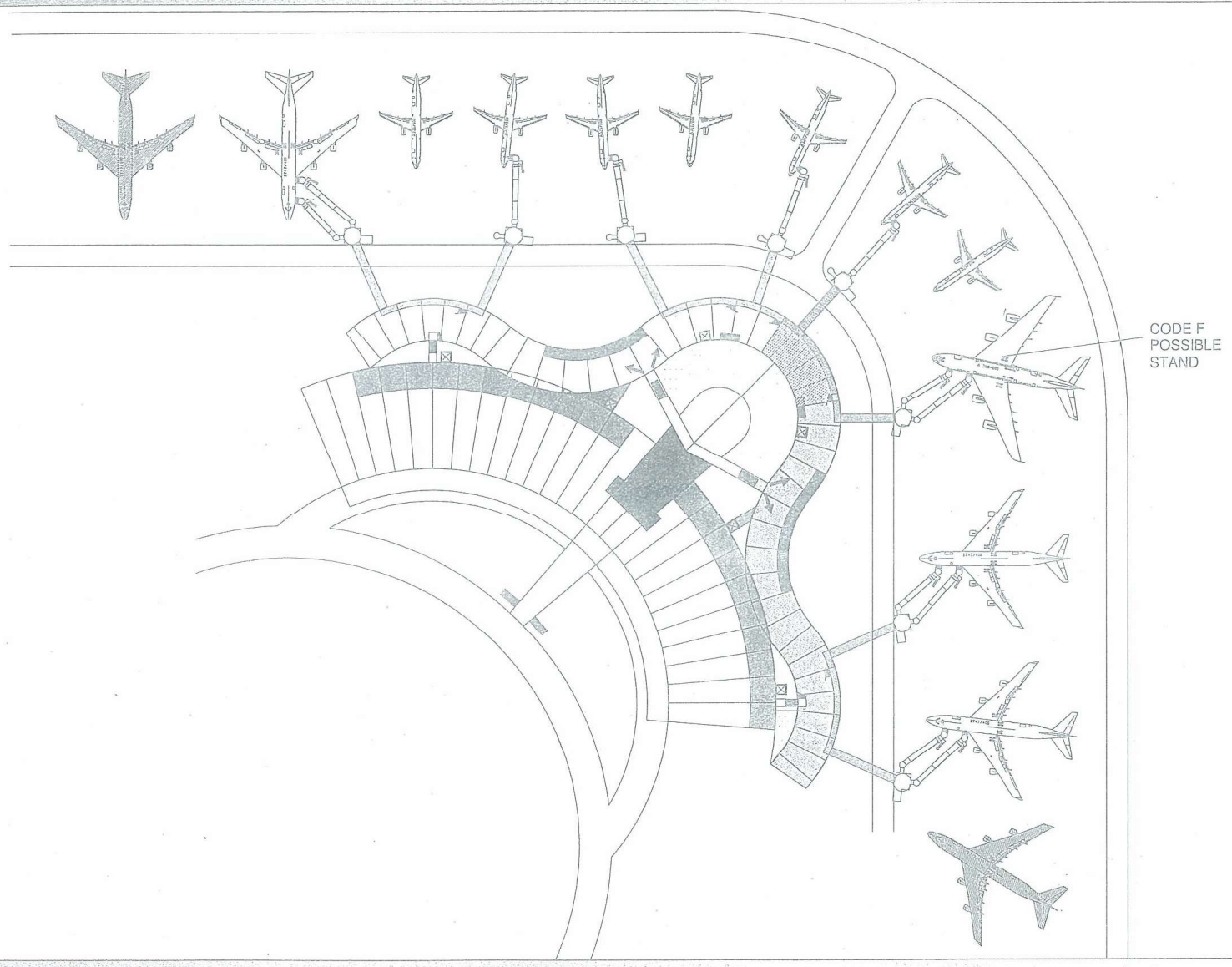
Scale :1/2000e

Date: August 2005

FEASIBILITY STUDY - ZONING PLAN LEVEL 0.00

ADPi

NEW GOA INTERNATIONAL AIRPORT



LEVEL +5.00

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- INTERNATIONAL PUBLIC HALL / CIRCULATION
- INTERNATIONAL ARRIVAL
- DOMESTIC DEPARTURE
- DOMESTIC PUBLIC HALL / CIRCULATION
- DOMESTIC ARRIVAL
- INTERNATIONAL / DOMESTIC DEPARTURE
- INTERNATIONAL / DOMESTIC ARRIVAL
- OFFICES AND TECHNICAL ROOM
- SHOPS / RESTAURANT / DUTY FREE
- GARDEN
- RESERVE AIRCRAFT STANDS

THE NUMBER OF AIR BRIDGES IS DEFINED SO AS TO HAVE 70% OF AIRCRAFT AT CONTACT STANDS DURING PEAK HOURS

0 20 40 60 80 100

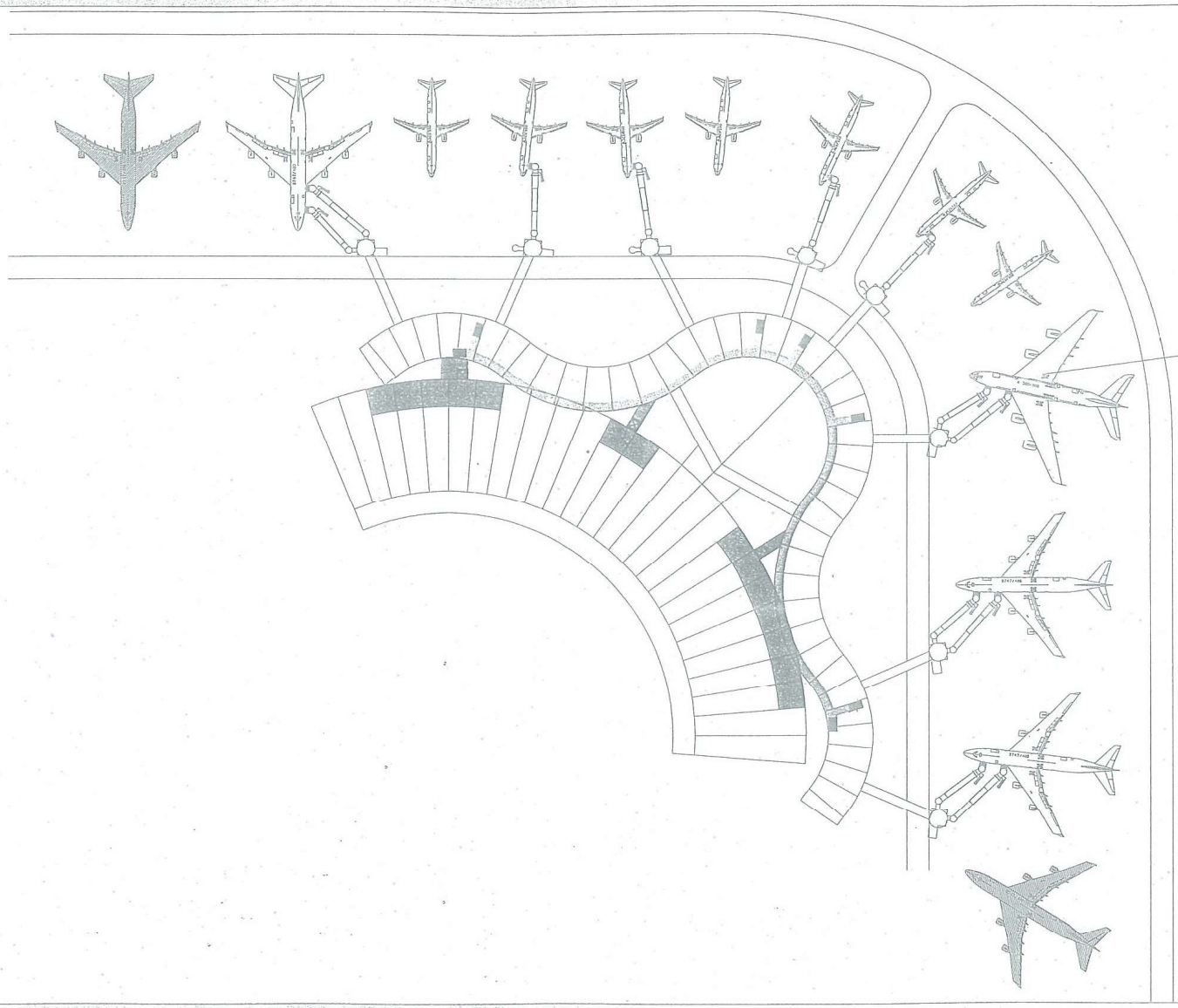
Scale :1/2000e

Date: August 2005

FEASIBILITY STUDY - ZONING PLAN LEVEL +5.00

ADP.i

NEW GOA INTERNATIONAL AIRPORT



LEVEL +9.00

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- INTERNATIONAL PUBLIC HALL / CIRCULATION
- INTERNATIONAL ARRIVAL
- DOMESTIC DEPARTURE
- DOMESTIC PUBLIC HALL / CIRCULATION
- DOMESTIC ARRIVAL
- INTERNATIONAL / DOMESTIC DEPARTURE
- INTERNATIONAL / DOMESTIC ARRIVAL
- OFFICES AND TECHNICAL ROOM
- SHOPS / RESTAURANT / DUTY FREE
- GARDEN
- RESERVE AIRCRAFT STANDS

THE NUMBER OF AIR BRIDGES IS DEFINED SO AS TO HAVE 70% OF AIRCRAFT AT CONTACT STANDS DURING PEAK HOURS

0 20 40 60 80 100

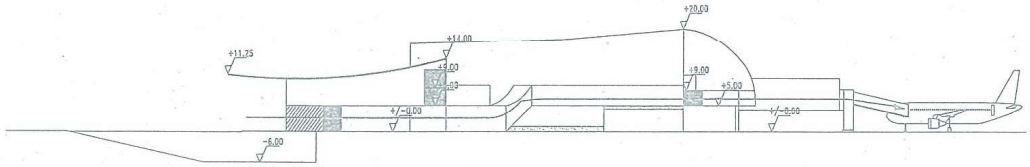
Scale :1/2000e

Date: August 2005

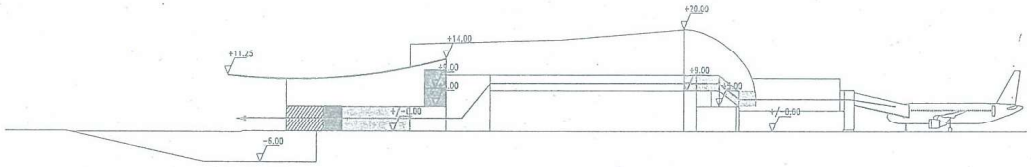
FEASIBILITY STUDY - ZONING PLAN LEVEL +9.00

ADPi

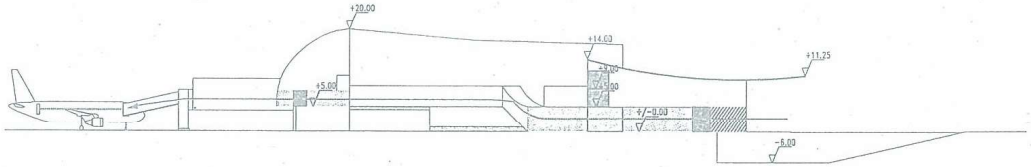
NEW GOA INTERNATIONAL AIRPORT



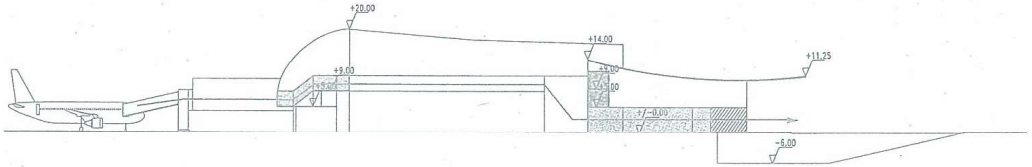
DOMESTIC DEPARTURE



DOMESTIC ARRIVAL



INTERNATIONAL DEPARTURE



INTERNATIONAL ARRIVAL

- INTERNATIONAL DEPARTURE
- INTERNATIONAL PUBLIC HALL / CIRCULATION
- INTERNATIONAL ARRIVAL
- DOMESTIC DEPARTURE
- DOMESTIC PUBLIC HALL / CIRCULATION
- DOMESTIC ARRIVAL
- INTERNATIONAL / DOMESTIC DEPARTURE
- INTERNATIONAL / DOMESTIC ARRIVAL
- OFFICES AND TECHNICAL ROOM
- SHOPS / RESTAURANT / DUTY FREE
- GARDEN
- RESERVE AIRCRAFT STANDS

THE NUMBER OF AIR BRIDGES IS DEFINED SO AS TO HAVE 70% OF AIRCRAFT AT CONTACT STANDS DURING PEAK HOURS

0 10 20 30 40 50

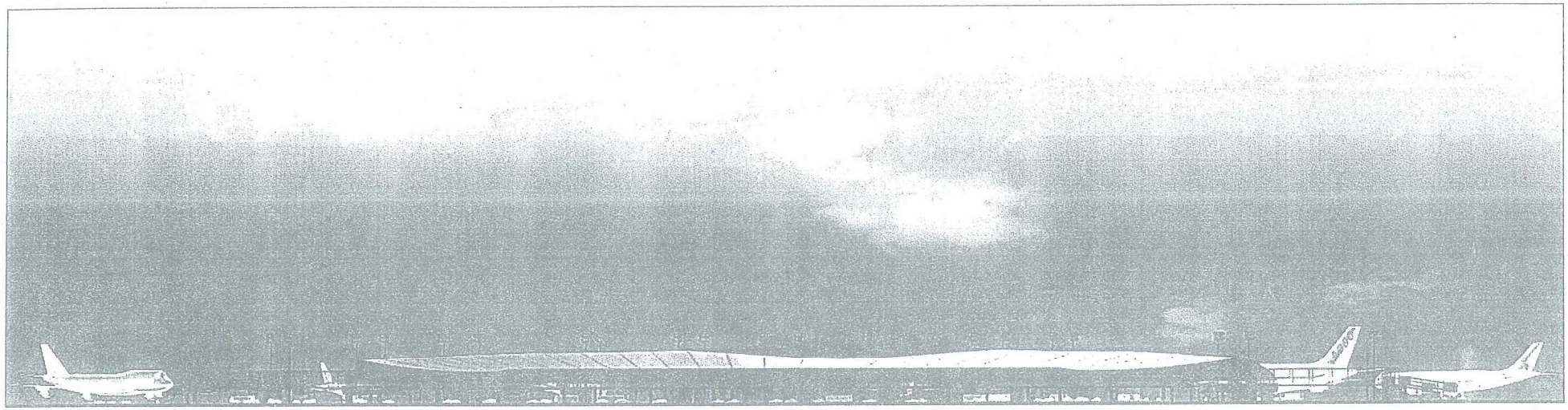
Scale :1/1000e

Date: August 2005

FEASIBILITY STUDY - TYPICAL SECTIONS

ADPi

NEW GOA INTERNATIONAL AIRPORT

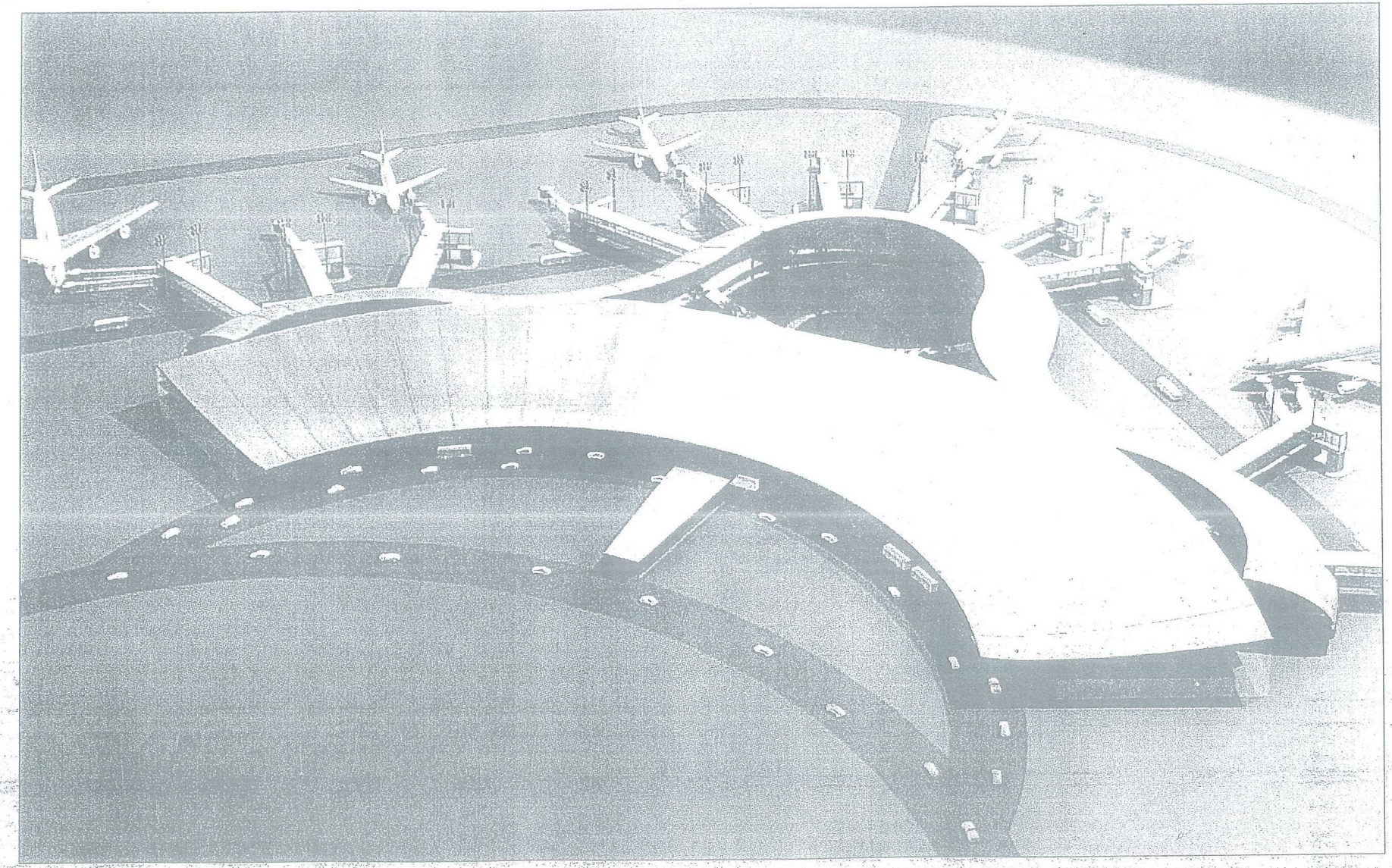


Date: August 2005

FEASIBILITY STUDY - LANDSIDE AND AIRSIDE ELEVATIONS

ADPi

NEW GOA INTERNATIONAL AIRPORT



Date: August 2005

FEASIBILITY STUDY - 3D VIEW 1

ADPi

Golf course

The area for a 18 holes golf course will be reserved on the airport site. The golf course will be located on the less valuable area of the site.
This Golf course should be removed when a second runway will be required.

The need is for 630 000 m² (2014 and 2034 and ultimate development).

Employee's accommodations

A specific area will be reserved for employees accommodations.

As Mopa site is located on a distant site from Dabolim airport, the hypothesis is to offer accommodation for a majority of the AAI and government employees. We will use for an hypothesis an offer for 2/3 of these employees which should lead to approximately 60 employees/Mpax of annual traffic.

With an average of 65 m²/employee (and family when necessary), the need is then for :

	2014	2034
Accomodation gross area	10 334 m²	28 462 m²
Land requirement	16 320 m²	42 481 m²

Total area is based on a ground occupation ratio of 0.67 common for moderately dense urban area.

For ultimate development, it is necessary to have 58 000 m2.

6.3.12. Road network

The road network is a critical tool for the functioning of the airport.

It is necessary to build the master plan to allow the best repartition of traffic flows. One of the key rules is to separate as soon as possible passengers traffic and employees/technical traffic.

Access to the cargo area, technical area, maintenance area, general aviation & helicopters & & business aviation area should use a specific part of the road network to lighten terminal access occupancy at peak time.

On the apron, the service road network will allow easy access to the aircrafts for handling operations. It will offer an efficient link between the cargo area and the passenger apron so as to allow a quick transfer of belly cargo to passenger aircrafts.

The road will be 2x1lanes (2014) but reservation for 2x2 lanes will be provided (2034 and ultimate development).

6.3.13. Railway connection

The Pernem railway station seems to be well located for the transportation of passengers and employees as well as for goods and merchandises. This station belongs to Konkan Railway.
It could be interesting to upgrade this station so as to create an intermodal complex that could handle containers from trains to trucks that will link the station to the new Goa airport. The facilities can also be defined so as to able the preparation of ULD containers to be directly loaded in planes.
During a later stage of development of the airport a more direct access road from Pernem to Goa could be built so as to optimise the connection.

6.4. Aeronautical facilities dimensioning

This chapter shall be read in regard with the Air Traffic forecasts, and especially with the expected peak hour in terms of movements. In order to size the aeronautical infrastructures the pertaining peak hour has been defined as the sum of the two busiest hours of the day considered in traffic forecasts. This assumption is conservative and will ensure a proper welcoming of high traffic on the plat form.
They assumed runway peak hours are as follow :

Passenger Aircraft Movements (Busy Hour)	
Year	Total Arrival + Departure
2014	15
2034	27

There are several possibilities to handle expected traffic on an airport. The main objective of this analysis is to define for the new Goa International airport the runway/taxiway system that will be efficient as well as cost effective. This work has been carried out in regard with airport accessibility and capacity for opening phase (up to 2014), long term phase (2034) and ultimate development.
The main parameter for runway/taxiway system is the Runway Occupancy Time studied with the help of a FAA approved software, REDIM, through several runway system analyses (capacity issues).
The second important issue is airport accessibility defined from different parameters such as runway characteristics and local constraints faced to International rules.
The defined runway system thus has to integrate the various possibilities of the site in order to optimise, as well as possible, the whole of the factors which results of the analysis in having the best cost for the project compared to the required runway system capacity.

The Navaids and Radar equipment and aeronautical procedures will also impact the capacity of the airport. We will suggest a solution for implementation of a theoretical scheme to access/exit from the airport. SIDs and STARs are defined for the main traffic flows (Europe, Middle East…).

6.4.1. Runway characteristics

The main characteristics of the runway to be built are independent from the considered Master Plan solution. They are related to the farest destination to be reached and the critical aircraft in terms of:

- Performance, for the runway length.
- Geometry (code of the aircraft) for the other characteristics

Runway length

The **destination** considered is London.
The **critical aircraft** studied are the B747-400 and the A340-300. Four-engines aircraft are more penalising than two-engines ones, due to (N-1) engines take off distance certification.
The **reference temperature** is 35°C.
The **airport altitude** is 160 m AMSL (around 525 ft).
The **runway condition** is wet.
The **runway slope** taken into account is 0.8%, corresponding to the maximum allowed runway slope on the 900 meters from the threshold (imposed by the signal of localizer).

From future Goa International Airport, the destination to join is characterized by:

Block Time :	11 hours
Km :	7,600
Nautical Miles (NM) :	4,105

The distance taken into account is 4150 NM.
The chosen aircraft will need to be at their maximum load of fuel. The runway shall be designed to allow the max payload. When adding max fuel and max payload (both passengers and freight for remaining load), the runway length shall be computed for the Maximum Take Off Weight (MTOW) of the aircraft.

Methodology
For Master Planning purpose two different methods can generally be used to compute runway length requirements and are the ICAO method (using correction coefficient) and the manufacturer method (based on the Airport Planning Manual).

The first method is not suitable for high temperature, altitude and slope conditions that make the use of linear correction inappropriate. Moreover the reference length is not available for the A380 so computation can only be down with the B747.

The second method is used to compute runway length requirements..

The required take-off length is:
1. B 747-400 : 3 750 m
2. A 340-300: 3 700 m
3. A 380-800: 3 500 m[3]

The required landing length is assumed to be 60% of take-off length.

The Consultant recommends to build a runway that has the following characteristics:

- West flow : TORA = TODA = ASDA = LDA = 3 750m
- East flow : TORA = TODA = ASDA = 3 750 m, LDA = 3 230m[4]
- Runway width = 45 m.
- Runway shoulders width : 7,5 m at each side in first phase (would be 15 m in future for A 380 adaptation).

These declared distances are sufficient to take off at Maximum Take Off Weight without any constraints in payload or freight for the critical aircraft panel and to land at Maximum Lading Weight in wet conditions, ensuring safe operations.

6.4.2. Obstacle and navaids clearances

6.4.2.1. Obstacle limitation surfaces

According to the Terms of References, all airport design will satisfy ICAO requirements for precision Approach CAT I.

Therefore, following obstacle limitation surfaces shall be established :

- conical surface
- inner horizontal surface,
- approach surface and inner approach surface,
- transitional surfaces,
- inner transitional surfaces,
- balked landing surface.

[3] Preliminary data, to be confirmed by Airbus
[4] A displaced threshold is recommended to avoid installation of very high masts for the approach ramp of ILS 09.

Proposed geometrical standards according to ICAO and Terms Of References are presented in the table below :

	ICAO Precision Approach code 4 and CAT I
Conical	
– slope	5 %
– height	100 m
Inner horizontal surface	
– height	45 m
– radius	4 000 m
Inner approach	
– width	120 m
– distance from threshold	60 m
– length	900 m
– slope	2 %
Approach	
– length of inner edge	300 m
– distance from threshold	60 m
– divergence (each side)	15 %
– first section	
· length	3 000 m
· slope	2 %
– second section	
· length	3 600 m (1)
· slope	2.5 %
– horizontal section	
· length	8 400 m (1)
· slope	15 000 m
Transitional	
– slope	14.3 %
Inner transitional	
– slope	33.3 %
Balked landing surface	
– length of inner edge	120 m
– distance from threshold	1 800 m (2)
– divergence (each side)	10 %
– slope	3.33 %

(1) variable length. The approach surface shall be horizontal beyond the point at which the 2.5 percent slope intersects :

- a horizontal plane 150 m above the threshold elevation, or
- the horizontal plane passing through the top of any object that governs the obstacle clearance limit whichever is the higher.

(2) or end of runway, whichever is less.

Additional requirements according to ICAO for take off obstacle limitation surfaces are presented in the table below :

	ICAO Code 4
Take off climb	
– length of inner edge	180 m
distance from runway end	60 m
– divergence	12.5 %
– final width	1 200 m or 1 800 m (1)
– length	15 000 m
– slope	2 % (2)

(1) 1800 m when the intended track includes changes of heading greater than 15° for operations conducted in IRF, VFR by night.

(2) The operational characteristics of aircraft intended should be examined to see if it is desirable to reduce the specified slope of 2 % when critical operating conditions are to be catered to. If the specified slope is reduced corresponding adjustment in the length of take off climb surface should be made so as to provide protection to a height of 300 m.

If no object reaches the 2 % take off climb surface, new objects should be limited to preserve the existing obstacle free surface down to a slope of 1.6 %.

6.4.2.2. Navaids clearances

Clearance areas in which obstacles must be avoided or limited in height and number so as to guarantee the integrity of the transmitted radio electrical signals :
Critical and Sensitive areas for ILS equipment as defined in ICAO Annex 10 volume 1 part 2 of supplement C shall apply and are dependant on the type of operational use.

For obstacles clearances linked to Navaids, French standards have been used. The following specifications will be then be applied for navaids areas:

- Glide area: no obstacle and no excavation on a section extended from the antenna to the runway threshold with a minimum distance of 300 m and on a total width of about 400 m.
- Localizer area :
  - first zone corresponding to a half of a circle with a radius of 300 m centred on the point of reference, no obstacle and no excavation.
  - second zone corresponding to a half of a circle with a radius of 1000 m centred on the point of reference, and limited both side to 500 m from the runway axis, obstacle will be limited to a height corresponding to 1% slope from the distance between obstacle and point of reference.
  - third zone corresponding to a strip of 300 m both side of the runway axis along the runway, obstacles will be limited to a height of 10 m.

6.4.3. Taxiways configuration

1st stage – from opening up to 2014 (15 mvts A + D)

For the Opening phase (up to 2014), a single runway will permit to manage the expected peak hour traffic.
A parallel taxiway shall be partially built to feed the runway. A short back-track will be necessary before taking off for wide bodies (ie- any aircraft that necessitates 3 750m of runway length to take off). The length of back-track is:

- 520 m under East flow configuration,
- 250 m under West flow configuration.

A turning pad shall be implemented on each threshold.

Four perpendicular exits shall be built at first phase:

1. at displaced threshold for landing in 09 : *ie* at 520 m from physical end of runway,
2. at 3 000 m from threshold 09,
3. aligned with west end of passenger terminal apron – 250 m from threshold 27,
4. aligned with the taxiway that deserves General and Business aviation area at 2 550 m from threshold 27,

Two perpendicular exits are foreseen for each flow. Their precise location is based on :

- aircraft landing performances according to their approach speed category and MTOW category,
- master planning compatibility and optimisation (no crossing of Rapid Exit and perpendicular taxiway).

One Rapid Exit Taxiways (RET) shall be built at 1 800 m from each threshold in order to minimize the Runway Occupancy Time (ROT) on the runway.
The design of such exits is as following :

- Exit angle with runway axis : 30°,
- Curve radius : 550 m,
- Width : 25 m,
- Shoulders: 10,5 m at each side.
- Levelled strip : additional 7 meters from shoulders (total 60 m)

These RETs are more adapted to the increasing part of C code aircraft. The location of these facilities takes into account wet or dries conditions.

Qualitative analysis
The perpendicular access to runway that are located near thresholds will be used :

1. for Wide bodies aircraft : to reach runway before proceeding to the necessary back-track so as to have the maximum TO distance available,
2. for Narrow bodies aircraft : depending on airlines operational calculations and aircraft Take-Off Weights, to proceed to a back track or to directly take off on the remaining length of the runway (resp 3 230 m and 3 500 m under East and West flow).

The direct junction between the runway and the terminal is also aimed at limiting taxi times for arriving aircraft and minimizing back-track operations.

Quantitative analysis

Based on the traffic forecasts and the related fleet mix (in terms of movement), the average Runway Occupancy Time (ROT) will be 70 s for landing aircraft in wet conditions.

Long term – 2034 (up to 27 mvts/h A + D)

This stage of construction of airside infrastructures will provide the runway with double access at each threshold to ease by-pass by compensating for aircraft performance differences and to eliminate taxi delay in case of technical problems before alignment of previous aircraft.
A second parallel taxiway could be useful. It is possible to build it without major interference on operations.
Based on operating experience on the plat-form, the airport authority will be able to define the requirements for new taxiways. It can be assumed that new RETs dedicated for Code E aircraft located at around 2 200 m from thresholds will be required.

Quantitative analysis
The average Runway Occupancy Time will be approximately 60 s for landing aircraft and the fall in ROT shall increase the runway capacity to 30 mvts/hour (A+D).
Runway Occupancy Time for departing aircraft will also be reduced. The taxiway system will be designed in a way that limitations of capacity will be imposed by air navigation procedures (delays between Departures, Arrivals, Arrival and Departure, Departure and Arrival sequences).

Comments
The runway will not be closed during the construction of access to threshold 27, a displaced threshold could be temporarily declared in order to free the area of works.
The remaining runway length will allow the majority of normal operations. Nevertheless, some restrictions could be applied on payload and a particular attention shall be paid on operating conditions during this stage.

6.5. ATC Equipment, Navaids & Meteorological facilities

6.5.1. Radars and associated facilities

Radar coverage shall be ensured with a Primary Surveillance Radar (PSR) and a monopulse Secondary Surveillance Radar (MSSR). These two equipments will be co-implanted. Redundant link with Radar Data Processing central units shall be provided. A dedicated shelter (500m²) will be built just under radar tower.

6.5.2. Navaids

The Navaids to be implemented on the plat-form are :

- VOR[5] / DME[6], wich will be used for Arrivals and Initial Approaches, it will ideally be located at the East of the plat form on the extension of the runway axis, in order to facilitate navigation in the vicinity of Ghats mountains.
- ILS[7] / DME for each threshold. As far as implementation of a DME coupled with the ILS is concerned, there is no requirement for Outer, Middle or Inner Markers. The Localisers will be located at 310 m from thresholds on the runway axis. The precise locations of Glide Paths shall take into account the longitudinal profile of the runway and the altitude of aircraft at the vertical of threshold (50 ft in normal conditions). As a first approximation, the GPs will be located at 300 m from threshold, and at 120 m from runway axis. The ILSs shall be Cat I to ensure a sufficient regularity of welcoming aircraft. The two thresholds will be equipped because the prevailing winds are changing between monsoon period and remaining months. Cat I is a cost effective solution because there is no need for axial lighting on runway and for hot stand by of Power Supply.
- Approach Ramp will have a length of 900 m. Both thresholds will be equipped. As far as the western threshold is really close to the end of the plateau, and in order to avoid the implementation of huge masts or undue refilling areas, the Consultant suggests a displaced threshold (520m) for landings under east flows conditions. Consequently, inset approach lights shall be implemented in the runway pavement.
- PAPI[8] at each threshold.

6.5.3. RadioCommunication equipment & facilities

In regard with the number of frequencies to be provided at new Goa international airport, and with the architecture of the ATC dedicated radio communications, a specific Transmitting and Receiving Station shall be built at least 500 m from the Air Traffic Control Tower in order to avoid any interference.
An integrated back-up antenna will be implemented on a top of the Tower for emergency situations.

A building housing Transceivers and Receivers, as well as batteries and necessary HVAC equipment will be built. A floor area of 220 m² is sufficient until 2034.
For ultimate stage of development, it could be necessary to built another station dedicated to reception while exiting one will be used only for transmission.

Four antennae pylons shall be installed :
- two for reception (main & back up),
- two for transmission (main & back up)

The appliance of proper clearances between pylons results in a requirement of 6 600 m² for land requirement.

6.5.4. Meteorological facilities

[Aerodrome Meteorological Observing System] AMOS will be designed to monitor continuously weather conditions along the runways. In accordance with ICAO recommendations for Cat I operation, it will include three sets of wind sensors and three transmissometers along the runway. In addition a ceilometer should be installed at each threshold.
An automatic meteorological station shall be implemented in first stage of construction. There won't be any extension during further stages of development of the airport.
This meteorological enclosure (called MET garden) will be designed to house conventional meteorological equipment and required instruments which are not included in the Aerodrome Meteorological Observing System (AMOS).
The AMOS, together with observations from conventional instruments and human observations by the Meteorological Observer, will provide a continuous monitoring of the weather on the Aerodrome area, and will allow to issue weather information, that will be,

- displayed in graphical and digital forms to air traffic controllers,
- made available to concerned aeronautical users on the aerodrome through the Aeronautical Information System,
- disseminated in ICAO/WMO code forms (METAR/SPECI,SYNOP,TEMP,..) outside the aerodrome.

From these observations the aeronautical weather forecaster will prepare warnings and forecasts for the aerodrome (SIGMET, TAF,...),that will be distributed in the same way as above-noted observations.

The Met Garden should also house another ceilometer.

Within the Met Garden the following instruments will be installed :
- An automated weather station including wind speed and direction sensors, air and soil thermometers, humidity sensor, barometer, radiometer, sun duration sensor, raingauge. The data collection and processing unit will be installed in the Meteorological Office.
- Conventional instruments including a set of thermometers (dry, wet, maximum,minimum) in a Stephenson screen, tilting bucket raingauge and evaporation pan. A Kew barometer will be installed in the Meteorological Office.
- A ceilometer . Its control and display unit will be installed in the Meteorological Office.

[5] Very Omnidirectionnal Range
[6] Distance Measurement Equipment
[7] Instrument Landing System
[8] Precision Approach Path Indicator

7. Airport Master Plan layout

7.1. Airspace

7.1.1. Aeronautical procedures & obstacles

7.1.1.1. Airspace organisation

The following part describes basic features to feed an airport equipped with radar. All of these features may be not absolutely necessary, but they are seen as the most efficient ones when the context allows to implement them.

Principles

The basic scheme is based upon three principles, which become more and more essential when traffic increases:

- **safety**: it must be insured under normal circumstances but also when incidents suddenly occur, such as runway closure, bad weather, etc.
- **capacity**: it generally needs to avoid disruption in the stream of traffic and to alleviate as much as possible the workload of the controllers;
- **environmental aspects**: it is better to keep aircraft as high as possible when operationally possible in order to minimise both noise and fuel consumption.

Basic scheme

The scheme depicted in following figure allows to optimise the above criteria (the figure has been drawn for a runway system east/west oriented under west wind configuration; thanks to the symmetric pattern, the same kind of system can operate with opposite QFU). The main features of such a system are:

- dimension: square box of 40NM, reaching FL120;
- segregation: departures go out through the faces, arrivals come through the corners;
- elementary terminal en-route sectors: specialised to handle arrival or departure traffic;
- holding areas: located along the nominal arrival routes, at 30 NM of the runway in order to permit a good flexibility in the radar vectoring process;
- downwinds: parallel to the runway, located at about 5-8 NM from the axis at FL 80 or 90, above the initial departures (this allows a continuous descending profile for arrival aircraft and a continuous climb without levelling off for departures);
- regulation zone: a square of 10x20 NM at the end of the downwinds for radar vectoring in order to merge the arrival flows before ILS interception.

The surrounding airspace shall be redesigned so as to integrate the future requirements of the new Goa International airport. There will be two runways to be feeded, with a short final on ILS axis at 3°.

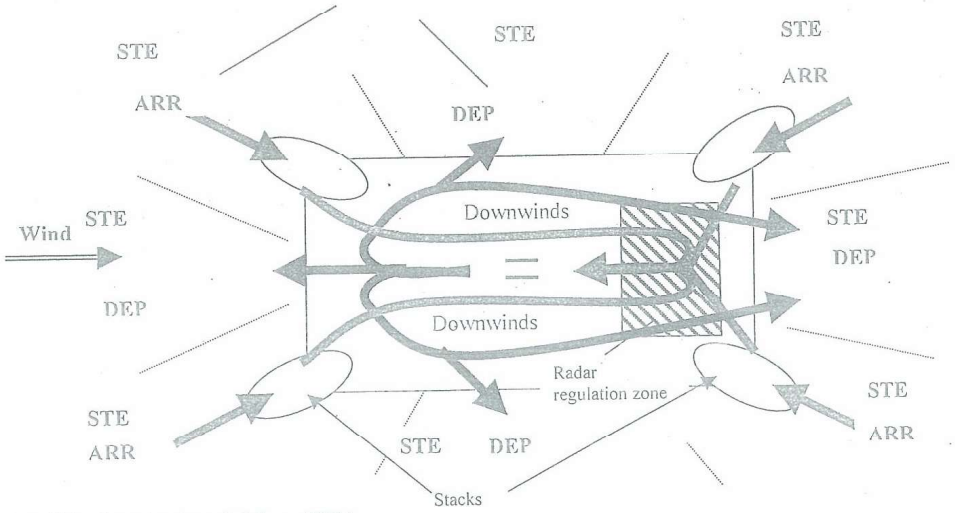


Fig 7.1 : Standard model for a TMA

Possible adaptations according to local features

- Capacity concerns: arrival and departures terminal sectors can be split or gathered or moved according to the amount and the geographical distribution of traffic; it is worth noticing that the most penalizing limitation is usually associated with arrival sectors (around 20 aircraft/hour for a single arrival route).

- A holding area or even an arrival route in the TMA may be not defined if there is very little traffic coming from the related direction, but they become necessary as soon as there are a few aircraft by hour; such a creation usually leads to modifications of routes in the upper airspace.

- Availability of airspace: the location of procedures may be shifted by a few nautical miles. In particular, downwind can take place further and lower to stay under departures path; or the regulation zone may be slightly modified. However, these adaptations may have a negative impact on the capacity of airspace.

- Runway operations: an offset has to be implemented in the altitude of ILS interception when two independent parallel approach are used.

Environmental concerns: the overflight of sensitive and/or numerous population has to be taken into account very early in the definition of trajectories and procedures.

En Route sectors

7.1.1.2. SID and STARs : first phase

The Air Traffic examination of the projected new Goa airport was carried out by ADPi on the basis of obstacle information supplied by Goan authorities. The contents of this chapter should be used carefully and considered only as a preliminary study.

All trees, natural obstacles and possible housings shall be removed from landing and take-off funnels. The plateau will be cleared from natural and artificial obstacles in the funnels. The obstacles located after the end of the plateau (East and West directions) will respect Obstacles Limitations Surfaces as defined in ICAO Annex 14 due to the altitude of the surrounding ground (50 m AMSL).

The site is located on a plateau that has the highest altitude than other reliefs in a 15 km radius circle. The physical environment that surrounds the airport site allows straight finals on both directions. The take off and landing paths are not infringed by any obstacle.

The Ghats Mountains are located 30 km eastward and the heights of the peaks (more than 1000 m) could impact SID and STARS.

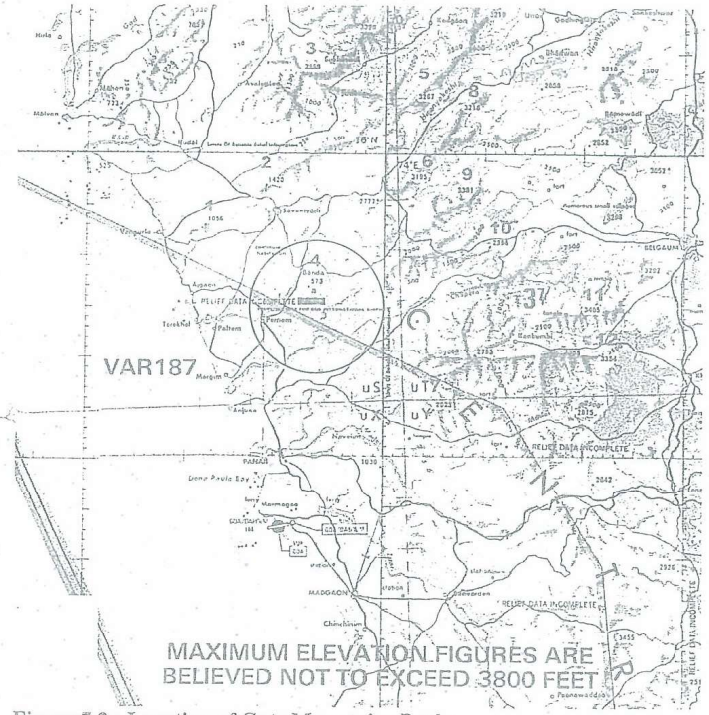


Figure 7.2 : Location of Gats Mountains Peaks

Elevations of important peaks with Northing and Easting

POINT	NORTHING			EASTING			ELEV. IN MTS	REMARKS
1	15	53	8	73	42	24	321,87	NE Vengurla
2	15	57	5	73	48	19	432,81	N Sawantwadi
3	16	9	8	73	54	38	871,42	W Sukevadi
4	15	47	7	73	52	36	174,65	N Site
5	16	5	35	74	3	22	995,78	N Amboli
6	15	57	37	74	2	50	[illegible]84	S Amboli
7	15	34	55	74	5	28	[illegible]0,61	Vagheri
8	16	4	14	74	8	2	980,84	NE Amboli
9	15	56	17	74	7	32	1030,53	SE Amboli
10	15	40	17	74	9	25	851,91	Chorla Ghat
11	15	44	26	74	20	24	1037,84	NE Kankumbi
12	15	39	39	74	21	56	1022,30	E Kankunbi
A.	15	44	33	73	51	48	172,15	AT SITE

Table 7.3: Height and Coordinates of Ghats Mountains Peaks

Runway headings based on Magnetic North.

Take-off 09

Departing aircraft will turn North or South as soon as possible to avoid the flying over mountains before having climb sufficiently.

Landings 09

Aircraft landing 09 will proceed to straight approaches, with interception of ILS at 3000 ft (nominal slope of 3°).

Take-off 27

Straight Take off, then reach its FPL.

Landings 27

The majority of initial approaches will take place in the southern part of the TMA in the first phase, the other arrival sectors will be opened in regard with traffic volume. (as per indicated in the theoretical scheme n° 7.1)
Due to the proximity of Ghats Mountains in the axis of runway, it is necessary to minimize the length of the final. The interception of ILS slope will be made at 2000 ft over threshold altitude.

The length of the final will be :	6,3 NM.
Alignment (30 s of flight at the same altitude)	2,0 NM
Curve and clearances	3,0 NM
Total :	*11,3 NM(21 km)*

As Ghats are located 30 km away from threshold, Cat I precision approaches can be implemented on threshold 27.
The Radar equipment used to manage the Radar Vectoring procedures should be equipped with MSAW[9] and should have a primary and secondary coverage. In this case it will be possible to align numerous aircraft in order to sequence the arrivals and reach optimum capacity.

7.1.2. Possible Conflict with Dabolim Airport

The Dabolim airport has a single runway orientating 081/261 (Magnetic).
The precise magnetic orientation of the planned runway at the new Goa International Airport is 090/270.
These two runways will need to operate simultaneously. Goa Traffic will be composed of civil one while Dabolim will manage military 's .
These two types of traffic have to be properly segregated.

The distance separating the two runways is bigger than 50 km. When considering ICAO recommendations given in the Circular 207-AN/126 - SOIR, it is assumed that that those two runways that form an angle lower than 15° can be classified and operated as quasi-parallel runways.

The quasi-parallel runways are managed like parallel runways when the converging point of the continuation of their axis is over the Final Approach Fix (FAF). This FAF is usually defined at around 10 NM (18 km) from threshold. According to the spread distance between the two airports, it can be assessed that the various trajectories followed by aircrafts in holding areas or during alignment on runway axis will be sufficiently separated to allow safe simultaneous operations of these two airports.

Appropriate Radar coverage and efficient means of communication/coordination between Military and Civilian Air Traffic Services will however to be implemented.

7.2. *Master Plan layout*

7.2.1. Main principles

The analysis of detailed topographical survey and the will of minimising the investment costs for the first phase of construction has lead to focus on one master plan solution. The recommended principle is to design a midfield terminal concept, with a first runway on the northern plateau and a second runway on the southern plateau in a far future.

The layout and land uses on the airport site under various development concepts are subject to certain principles related to:

- Location of the passenger terminal - The passenger terminal is the largest of the new Goa International Airport land use zones and accommodates the airport's most important operational activities. Thus, its location is the foundation of the airport land use layout.
- Adjacency between facilities - The cargo, catering, and flight operations terminals should be near the passenger terminal complex for functional efficiency.
- Aircraft access to certain facilities - Aircraft must have immediate access to the passenger and cargo terminals and aircraft maintenance base for short taxiing distances to minimise operating costs.
- Other special requirements - The central plant should be located centrally to major heating and cooling demand centres. Transmitting & Receiving VHF stations shall be located at least at 500 m from Tower and one from the other.

The airside service roads will be laid out to allow good, direct connection with the different airport facilities. In particular, because of the high forecast of cargo transfer (belly cargo and freighter cargo), there will be a heavy GSE traffic between the cargo area and the passenger apron.

A perimetral road shall also be implemented for securtiy purpose and access to various equipments of the airport (Localizers, approach ramps...).

Definition of installation frontage

The distance between runway axis and installation frontage shall be define in regard with future taxiway system and aircraft stand depth. The devices to be positioned are[10] given with associated clearances or size :

Devices	Distance
Runway axis to parallel taxiway axis...	190 m
... to 2nd parallel taxiway axis...	97,5 m
...to taxilane axis...	97,5 m
...to tail service road...	50,5 m
...width of service road...	10 m
...to aircraft stand...	7,5 m
...depth of aircraft stand...	80 m
...to front service road...	7,5 m
...width of service road	10 m
Total	550,50 m

The principles to establish the Master Plan layout are those used for similar airports. The various passenger installations shall be gathered in a dedicated area located on the connection between the two plateaus.

Location requirements
The support facilities and commercial developments can be categorized in the following eight groups, based on their location requirements :

1. Facilities that need aircraft access (facilities that must be located along a taxiway):
   - Cargo complex
   - Aircraft maintenance base
   - Business & General aviation facility

[9] Minimum Safe Altitude Warning

[10] Based on Code 4F ICAO standards

2. Facilities that need to be adjacent to the passenger terminal, with a good airside road connection to the passenger terminal:
   - Cargo complex
   - Catering facility
   - GSE maintenance facility

3. Facilities that need to be located near the centre of the midfield:
   - Air traffic control tower
   - Rescue & Fire Fighting main station

4. Airline facilities that need to be in the midfield area and near or integrated to the aircraft maintenance base:
   - Airline engineering facility
   - Airline operations building

5. Airport operations and staff support facilities that need to be in the midfield area:
   - Airport administration building
   - Airport maintenance facility
   - Meteorological facility
   - Employee canteen
   - Medical centre

6. Facilities that do not need to be in the midfield area:
   - Fuel farm
   - Wastewater treatment plant
   - Solid waste handling centre/incinerator
   - Centralized employee parking lot
   - Helipad

7. Commercial developments that do not need to be in the midfield area:
   - Business park
   - Hotel
   - Petrol station
   - Rental car service areas

8. Other support facilities will be located within the passenger terminal zone and are not shown separately on the land use plan:
   - Central utility plant
   - Airside vehicle fuelling station
   - Apron aircraft fuelling station/tanker loading station
   - Aircraft waste disposal station.

Facilities that need to be adjacent to the passenger terminal (Group 2 above) are located along the taxilane, west of the passenger terminal complex.

- The catering facility and the GSE maintenance facility should be located along the taxilane close to PTB[11] to minimize distance for vehicles that must travel between these facilities and the passenger terminal zone.

Facilities that need to be near the centre of the airfield (Group 3) are located along the taxilane and mid-way between the two thresholds of the first runway.

- The air traffic control tower should be designed to give a clear view on runways and taxiways, (visibility on Northern airside area is privileged because if a second runway is built in the future, a new control tower could be raised simultaneously).
- The main fire station should be located along the taxilane and have a dedicated road that accesses to runway so that emergency response vehicles can access any point in the aircraft operations area within three minutes. A satellite fire station could be located south of the midfield area when building the second runway.
- The airport operations and staff facilities (Group 5) should be located in the remaining midfield area, away from the taxiways.

The other utility facilities and commercial developments, that do not require a midfield location (Groups 6 and 7) are located in two dedicated places.

- The utility facilities (Group 6) should be located according to specific requirements. The wastewater treatment plant should be located toward the west end of the site, where the prevailing easterly winds will prevent odours from affecting other airport facilities. The fuel farm and centralized employee parking lot can be located farther north, where there will be no conflict with the commercial developments.

The commercial developments (Group 7) should be located where they will be served by a dedicated access road.

The following activities require less than 1 ha that is the reason why the location characteristics are similar from one scenario to another one:

- Control point (11)
  This access point to airport restricted areas is located at the west of the main facilities (Terminal, ATC building, GSE catering) and so close to supporting facilities like cargo and maintenance area.
  Then the control point is next to the service road, at installation frontage, to ease vehicle entrees.
- Custom and police (23)
  The police need to be next to the control point (or close to it) for vehicles inspections and employee controls before entering airport restricted area.
- Sewage and waste water (25), solid waste handling centre/incinerator (26), water supply (24):
  Those activities are far away from installation frontage and are located at the east of the airport along the road joining the cargo and maintenance area from the main roundabout.

[11] Passenger Terminal Building