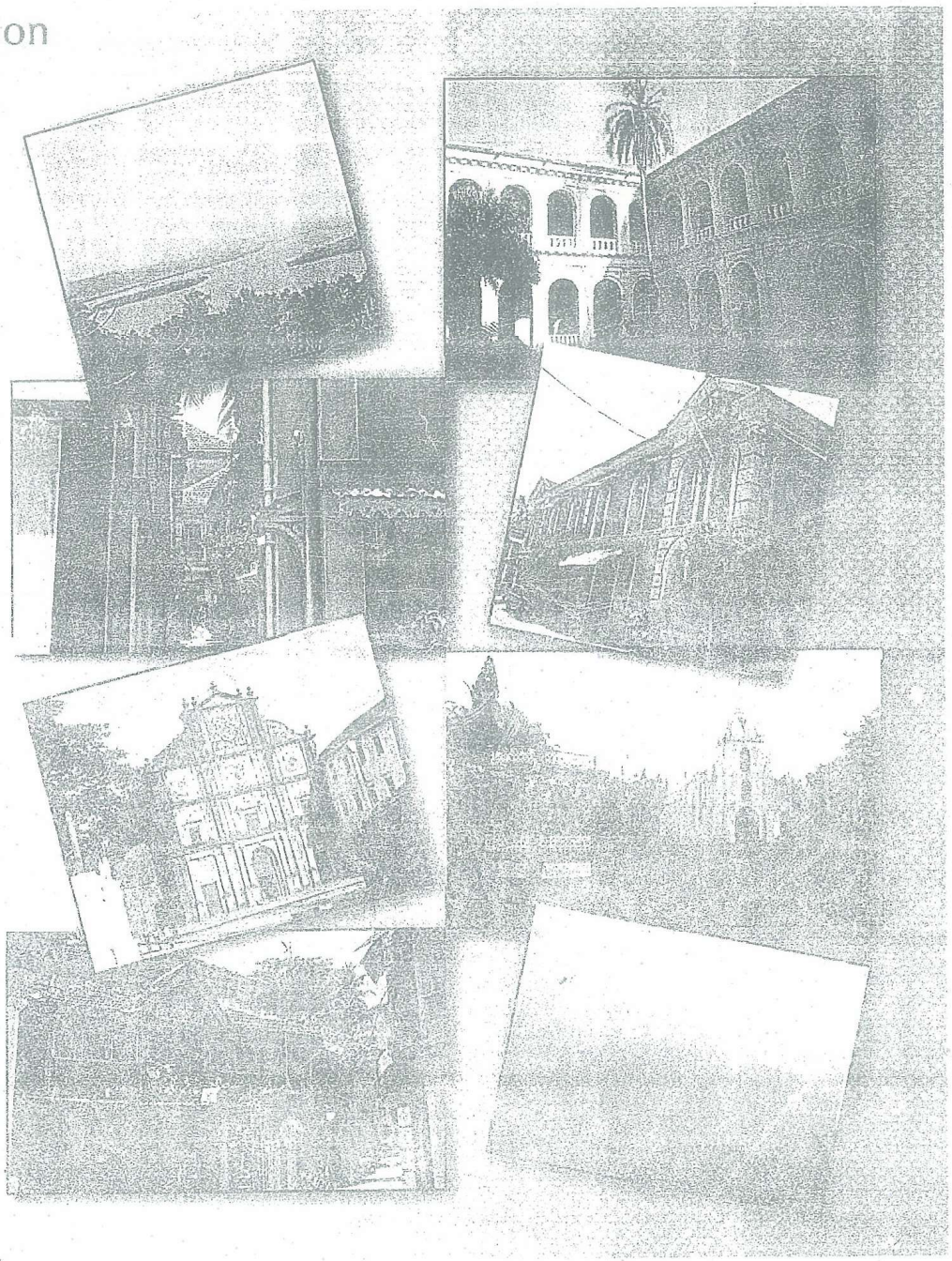
International Civil Aviation Organisation
for Government of Goa

Final Report
New Goa Airport
Feasibility study



with

STUP Consultants P. Ltd.
Mumbai

IATA

August 2005

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Table of Contents

1. Reminder of the Terms of Reference

The New Goa Airport Feasibility Study is an essential instrument for studying and analyzing the appropriate possible configurations for the new airport as well as its financial feasibility and various impacts, for then establishing the basis for guiding its growth from inception to ultimate development.

The objective of this feasibility study is to provide a rational, consistent and flexible physical framework within which the development of the new airport can keep pace with the growth of aviation activities as well as verifying its economical, social and environmental impact. It demonstrates the development potential of the airport and establishes the conditions for its development under a public-private partnership.

Objectives:

The Consultant will ensure that the feasibility study is developed so as to satisfy the following objectives:

- Forecast the medium and long-term development of the airport
- Establish the main features of the airport layout plan (runway orientation, areas dedicated to airport facilities)
- Organize each airport area so that it satisfies the short-term requirements while taking into account the requirement for future expansion
- Set the interrelations with the surrounding areas (access requirements, environmental impacts, economic impact)
- Ensure that airport characteristics will comply with international standards
- Analyse the financial impact of phased development
- Establish the various possible conditions for financing of the project (private/public stake holding,…)
- Assess the best solution for financing the project
- Prepare the Terms of References for private parties biding to build and operate the Airport.

Main constraints:

The Consultant will ensure that the following main constraints will be taken into account in its study :

- Compliance with international rules and practices, especially regarding security and safety
- Protection of the environment
- Compatibility of air navigation operations with Dabolim Navy Airbase
- Capacity to receive the critical design aircraft
- Capacity to accommodate the maximum ultimate use defined for the airport
- Compliance of the financial analysis with the local financial and manageurial context

Description of the feasibility study components:

The feasibility study will include:

- Air Transport Profile
- Air Traffic Forecast
- Topographical, geo-technical and material studies
- Chosen site assessment to physical, technical, operational, and Air Navigation compatibility
- General Airport layout plan
- Preliminary Obstacle clearance study
- Preliminary Radio Electrical clearance study
- Noise exposure plan
- Environmental and social impact study
- Definition of Phase 1 project
- Preliminary Concept plans of Main buildings phase 1
- Preliminary Concept plans of Infrastructures (runway, taxiway and aprons) phase 1
- Financial Analysis study
- Economic study

Regarding the Airport Layout, the main airport areas to be examined are as follows:

- Airport access and road networks
- Aircraft movement areas (runways, runway exits, taxiways, aprons)
- Passenger terminal
- Hotel if any
- Business centre if any
- Parking areas (car, bus, car hire, etc.)
- Cargo terminals
- Control tower and technical buildings
- Fire station
- General Aviation
- Aircraft maintenance
- Catering service if any
- Miscellaneous facilities (various workshops)
- Equipment for power generation (electricity), air handling (air conditioning), and treatment stations (rainwater, soil water, waste treatment)
- Fuel storage and supply
- Offices (for airport administration, airlines, and other uses)

Reports:
Five Reports have been or shall be submitted:

- *Inception Report (submitted by March, 2005)*
- *Draft Final Report (submitted by May, 2005)*
- **Final Report**
- Report on Financing Options
- Terms of References for private parties biding to build and operate the Airport.

2. Objectives of the Final Report

The Final Report will address the following tasks:

- Reminder of Main conclusion of inception report
- Final Traffic Forecast
- Airport requirements including :
  - Main building requirements,
  - Infrastructure requirements (airside and landside),
  - Requirements for airport services,
  - Requirements for Communication, Navigation, Surveillance and ATC services, meteorology equipments,
- Airport Layout Definition and phasing of development
- Project Identification Phase 1 including :
  - Identification of scope of project for Phase 1
  - Preliminary Concept plans for infrastructures (runway, taxiway and aprons, visual aids) phase 1
  - Preliminary Concept plans for major buildings (terminal building and control tower) phase 1
  - Preliminary cost estimate
  - Project implementation schedule
  - Organisational and administrative arrangements
- Financial analysis
- Economic Analysis
- Environmental and Social effects and Noise Impact Study

The Consultant will submit this document both to ICAO and to the Goa Government. The main objective of this report is to integrate and to balance comments of ICAO and Indian authorities raised on Draft Final Report and discussed during the meetings held in Goa July 25-27, 2005.

3. Conclusions of the Inception Report

3.1. Introduction

This section aims at reminding main conclusions of the Inception Report while describing major methodological aspects that were used as guidelines. It has to be pointed out that this Final Report should be read with reference to the Inception Report as Draft Final Report became obsolete further to the issuing of Final Report.

3.2. Design criteria

Thanks to consultant representation in Goa a complete data collection has been executed through numerous exchanges between consultants, airport authorities, airlines and four on site missions.

International standards (ICAO, ound and experience were used all along the project to ensure efficient, safe a ations at Goa airport. The choice of Design Aircraft consists in catering both with development strategy and with projected traffic. This reflection leads the Consultant to consider the B747-400 and the A380-800, the new large aircraft designed by Airbus, which is planning for the bear future operations in India, but only in Delhi and Mumbai first.

On account of the traffic structure forecasted in Goa, featuring a mix of personnal , business and leisure travel, it is advisable to make provision for occasionnal accomodation of A380 aircraft in Goa. But this does not imply the new airport to be planned as a full code F airport, which would significantly increased the investment and operating costs of the new airport.

Thus it has been adviced to plan the various airfield separations (runway-taxiway, taxiway-taxiway, taxiway-obstacle) in compliance with code F specifications, but keeping code E specifications for airfield facilities planning and design.

As a summary, the A 380-800 (Code 4F) will be retained as the design aircraft for long term airfield master-planning and for the weight to be taken into account in structural calculations of culverts, aircraft bridges.... The most recent code E aircrafts (A 340-600 and B 777-300ER) will be considered for the geometrical design of phase 1.

3.3. Site Assessment

3.3.1. Presentation of the context

Further to site evaluation study undertaken in 1997 by the Goan authorities, it was decided to develop the new airport project on the site known as Mopa.
Close to the Maharashtra border (North of Goa state) this airport will be an essential tool to develop tourism and to boost both local inhabitants and visitors travel.

3.3.2. Physical main characteristics

The site is located on two rather flat plateaus characterized by a 250 wide connection and at an altitude of 150 to 170 m AMSL. Most of the soil is made of lava rock, covered of high dry grass and so mainly used as extensive pasture land.

Inception Report has indicated that the plateaus were 5 km wide and there was enough place to spread on the northern plateau two runways, associated taxiways and terminal facilities. Latest topographical survey enabled to detail the site constraints and the runway location had to be adapted to comply with effective length of the plateaus, around 4 Km.
The site surface is sufficient nevertheless. It is surrounded by deep valleys (30 m depth) and natural ground falls after the plateaus with important slope at North, West and east directions.

The Ghats Mountains are located around 30 km on the East of the site and reach altitudes up to 900 m.

3.3.3. Environmental impacts

No major environmental issues existed that would preclude the construction of the new Goa International Airport.
This analysis involved a literature review and a reconnaissance-level field survey of the project area to identify existing conditions, a determination of the nature and quality of data that may be available from other nearby projects, and a preliminary review of the land reclamation needs for the new airport. As determined during our analysis, the proposed site is consistent with local plans developed by the Planning Department. The project can be planned and designed to comply with local and regional environmental regulatory standards.

The impacts of the new airport on the environment shall be assessed for the two following stages : construction and operation phase by considering three components: Land, Water and Air.
Adverse impacts are mainly caused during construction phase (movement, storage and extraction of bulk materials ...).

During the Operation Phase, the airport is likely to have the following adverse impacts:

- Noise impact, especially at night but should be reduced thanks to the limited number of settlement areas.
- Air quality: Air pollution generated by aircraft take off and landing patterns on fauna and flora.
- Waste management: suitable mitigation plan shall be prepared to deal with these issues by collecting, treating and disposing it in accordance with related compliance avoiding at the same time birds presence.
- Occupational health and safety: Construction and operation activities are sources of accidents.

3.3.4. Ground Networks

The study and design of networks would include the development of anticipated air and ground traffic and a smooth transition of the inter modal switchovers.
The disposal of passengers and goods traffic to their final destination by ground transport would be of primary importance.

Three main aspects could be put forward:

- The first point would be the transfer to the ground vehicles and movement of passengers and goods to the nearest trunk route i.e. NH-17 in this case that should be adapted for heavy vehicles.
- Therefore an alternate, more direct route has been identified in the interest of speedy construction and with minimum impacts on the environment.
- Thereafter, the adequacy of the present two lanes National Highway-17 to carry the full traffic when the airport operations reach their peak has been studied. Within the airport, the design of loop roads and parking areas should be done taking into account the safe and rapid movement of ground traffic on the land side.
- The Konkan Railway has a station 12 km westward from MOPA site. An intermodal node could be created in this region, either for passengers or goods (cargo) transportation.

3.3.5. Operational compatibility

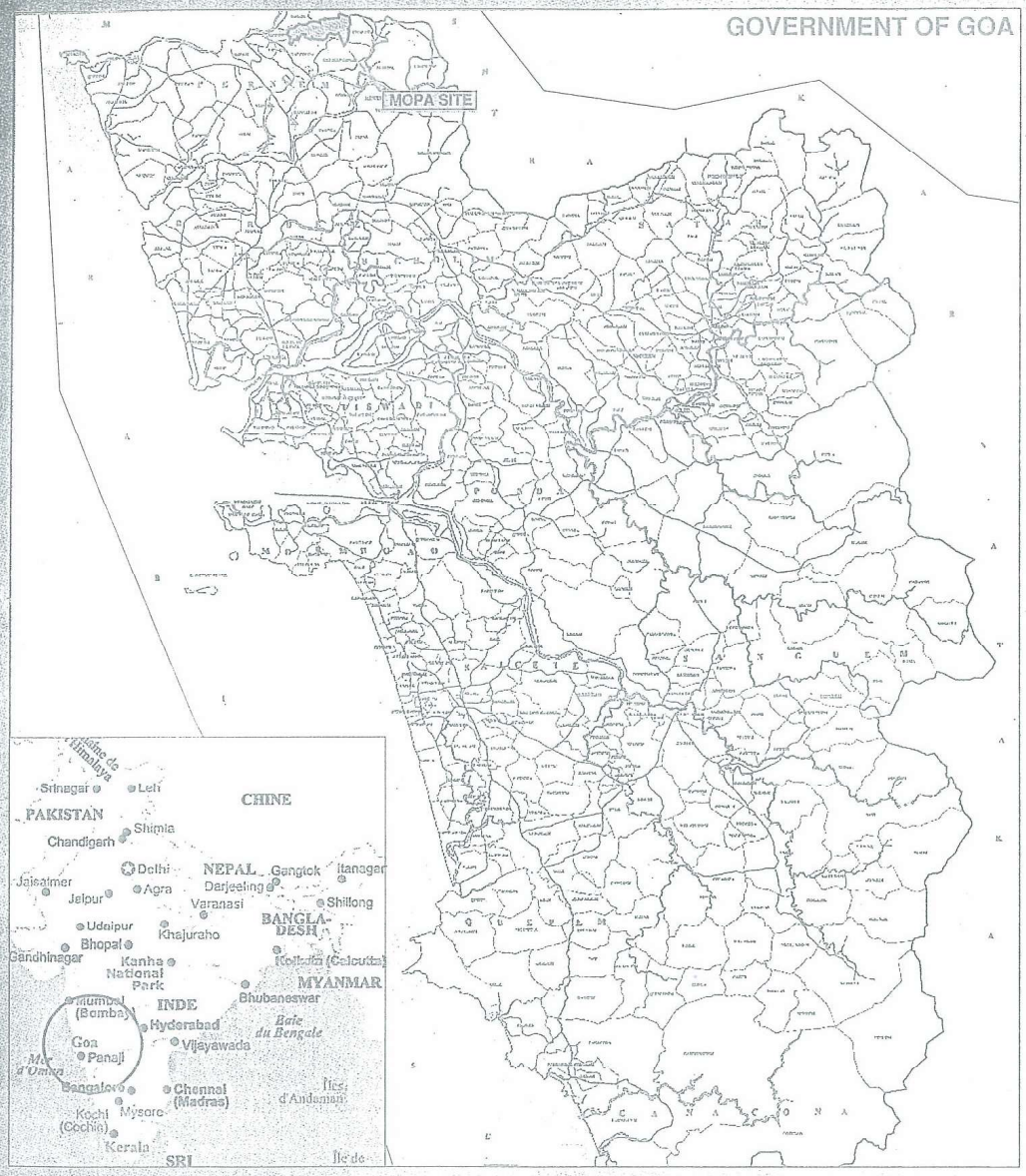
3.3.5.1. Meteorological conditions

Two MET stations have been used (at Panaji and Diabolim airport) collecting date from 1980 to 2004 although the main physical characteristics of the selected site could cause specific meteorological phenomena in the limited manner.
In regard of the collected data we recommend to implement a runway directed 09/27 as the base solution knowing that a flexibility of - 10° (0runway 8/26) is possible.
The aircraft operations to/from the airport will mainly be handled facing East. However, the inversion of wind direction distribution during the Monsoon season requires having an almost symmetrical approach for the design of runway and associated taxiways and for equipments.

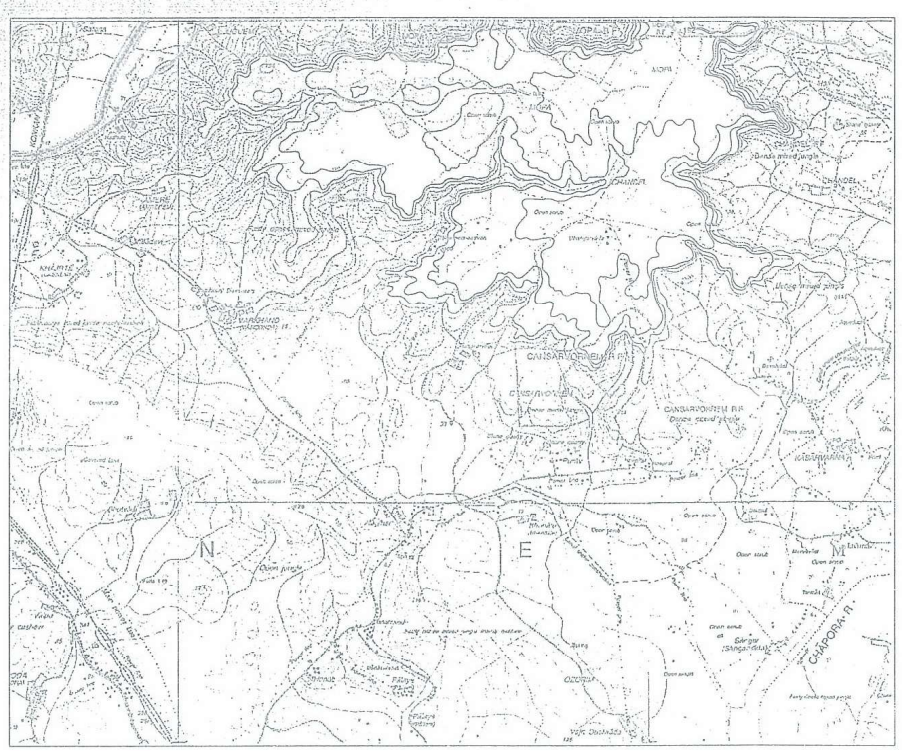
3.3.5.2. Assessment of Obstacles

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 (ICAO Annex 14).
The Ghats mountains locations are, at first approach, compatible with establishing safe IFR approach procedures.

NEW GOA INTERNATIONAL AIRPORT



INDIA

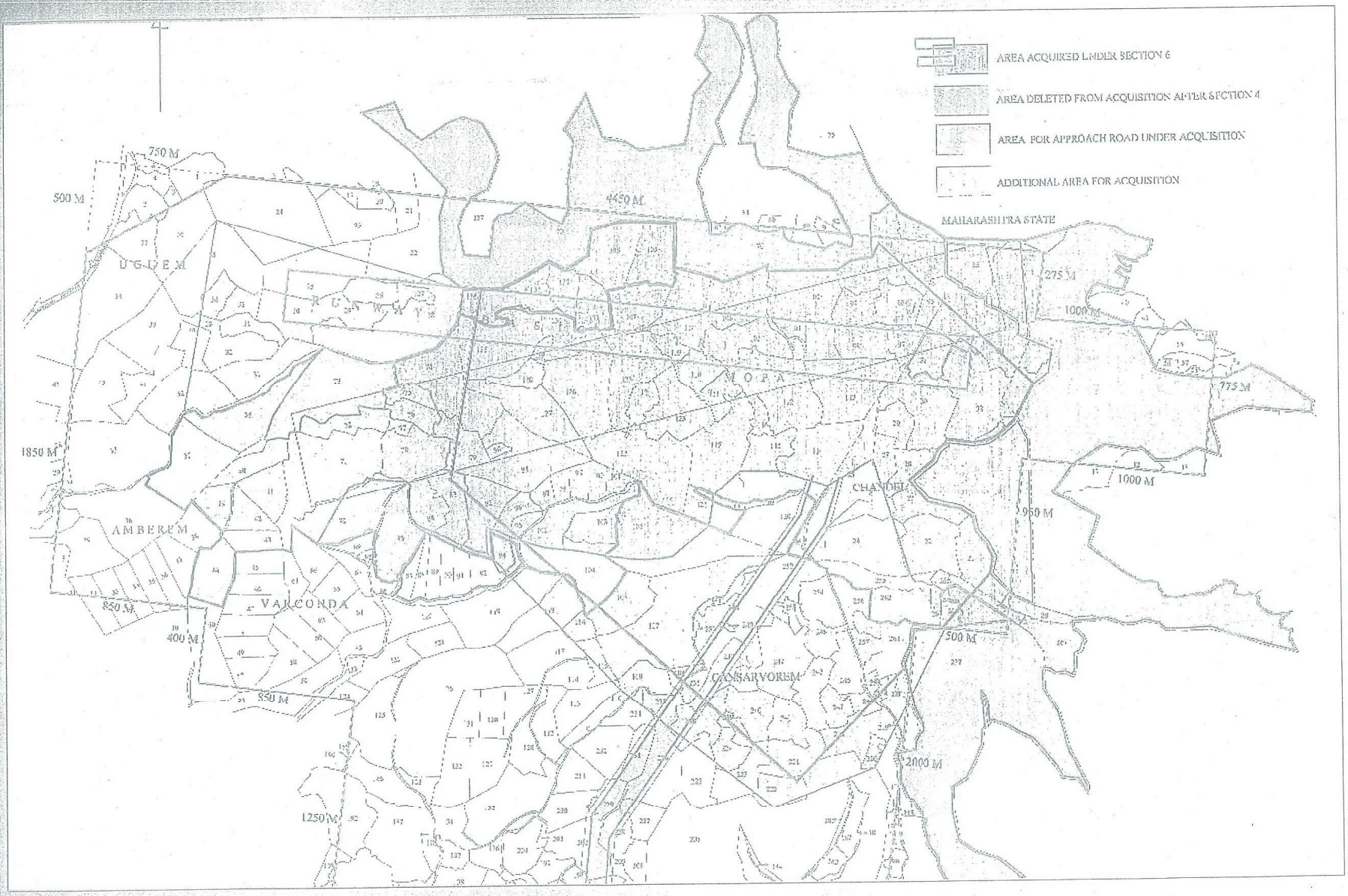


MOPA SITE

Date: August 2005

FEASIBILITY STUDY - SITUATION

NEW GOA INTERNATIONAL AIRPORT



FEASIBILITY STUDY - LAND ACQUISITION

Date: August 2005

3.4. Air Transport Profile

3.4.1. Status of civil aviation in India

The civil aviation sector and regulator regimes will be pushed hard to keep up with the demand. Increased liberalization of bilateral agreements will be demanded by a growing consumer group of business and leisure travellers wanting superior affordable access to an expanded range of destinations. Investment in airports and airlines for infrastructure and fleet expansion and renewal will accelerate the move towards privatization. The need to increase efficiency to enable and respond to the low cost model will necessitate a review of some of the potentially onerous operating requirements.

There is no turning back for the civil aviation sector. Liberalization, rapid-growth, restructuring, and facility renewal will be the norm for the next several years as the civil aviation sector plays catch-up to meet the demand of India's booming economy.

3.4.2. Regulatory Structure

Ministry of Civil Aviation

Oversight of civil aviation in India is the responsibility of the Ministry of Civil Aviation (MoCA), it is in particular responsible for the formulation of national policies and programmes for development and regulation of Civil Aviation and for devising and implementing schemes for the orderly growth and expansion of civil air transport.

The Ministry has oversight of the Directorate General of Civil Aviation, the Bureau of Civil Aviation Security, Air India, Indian Airlines, Pawan Hans Helicopters Ltd, Airports Authority of India.
The Directorate General of Civil Aviation (DGCA) is the principal regulatory body in the field of Civil Aviation. It is responsible for regulation, formulation and enforcement of civil air regulations, air safety and airworthiness standards.
The Bureau of Civil Aviation Security (BCAS) is responsible for laying down the standards of pre-embarkation security and anti-sabotage measures in respect of civil flights in India.
The Airports Authority of India (AAI) is responsible for operation of civil airports and civil enclaves within India

The DGCA is responsible for licensing of aerodromes, in particular Mopa airport and the participation of the BCAS will be required with respect to inclusion of necessary security features and requirements within the Mopa Airport.
In the event that Mopa Airport is developed under a build-and-operate contract, AAI would remain responsible for the Air Traffic Control activities.

Ministry of Home Affairs.

The Ministry of Home Affairs is responsible for all matters relating to internal security and the participation of the integrated Bureau of Immigration will be important to ensure adequate facilities and services within the new Mopa Airport.

3.4.3. Regulatory Environment

As addressed in the overview, the civil aviation regulatory environment is becoming increasing liberalized. Traditionally, however the MoCA has maintained a centralized and protective framework. In addition several areas are under changing regulatory environments and are specifically relevant to the feasibility and design of the Mopa Airport; these areas are: Bilateral framework, airport designation, greenfield policy and airport privatization.

3.4.4. Air Transport Operators

There are currently five relevant passenger airlines in the India market. These include Air India, Indian Airlines, Jet Airways, Sahara Airlines, and Air Deccan. As previously mentioned, Kingfisher, Air India Express, and SpiceJet have all announced their intention to launch a low cost carrier services.

3.4.5. Objectives of the State of Goa

3.4.5.1. Situation

The current Dabolim Airport has very little ability to expand to meet the needs of the economy and tourist industry for several reasons: business and residential development around the airport, ramp area limited to approximately 5 aircraft, inexistent overnight parking, small terminal, insufficient space for taxi and shuttle bus parking…
Faced to the importance of tourism in state economy and to ensure the growth of the tourist sector the government wishes to take the necessary steps to provide for future capacity.
To follow up the demand and because of the very limited capacity of Diabolim airport the development of an entirely new facility may be the only practical way to appropriately expand capacity.

3.4.5.2. Strategy

The state has selected the Mopa site as the only practical location with suitable available land and without increasing access time to Panaji, limiting at the same time the effect on local habits.

However the new location could impact the access to southern beaches and resorts so the government intends to significantly upgrade the national highway and road transportation network to offset the impact of the more remote location.

The proximity to the main Konkan Railway line and to the state of Maharashtra provides opportunities to expand the catchment's area especially in terms of cargo.
The new airport principle has been conveyed by the government of India but the investment cost consist in an other issue. The balance of the financing, construction and acquisition cost, could be arranged through a Build, Own, Operate, and Transfer or similar type agreement.

3.5. Remarks raised by the Client on the Draft Final Report

This chapter lists the remarks raised by ICAO on the Draft Final Report and gives Consultant answers. As there have been numerous communications between the Parties , this Chapter is only focusing on recommendations, consensus, or conclusions relevant in the frame of this report.

REVIEW OF CONTENTS

SECTION 3: Conclusions of the Inception Report

Paragraph 3.3.2: (Physical Main Characteristics)
(also Paragraph 7.2.1)

Observations:

(i). The Inception Report had indicated that the plateaus were 5 km wide and there was enough place for two parallel runways etc. on the northern plateau. Three scenarios were to be examined in detail. Detailed topographical survey has, however, indicated site constraints. That factor and the stated will (of the Government) to minimize the investment costs for the first phase of construction led to focus on one master plan solution. (As indicated by the Consultant in Master Plan – Ultimate Stage inserted between pages 67 and 72)

Paragraph 3.5: Remarks raised by the Client

Observations:

(i). Commenting on paragraph 2.6 of the Inception Report, The Consultant was requested to offer solutions to the construction/ operational and safety related problems that will be encountered in the future widening of the taxiways from 23m to 25m in very narrow lanes. The Consultant has opined to the effect that when the time comes in future, an aeronautical study should be conducted to evaluate risk quoting ICAO Circular on NLA operations on existing airports. The Consultant has further opined, basing it upon the manufacturer's contention and certain conclusions reached by AACG- a group of four European nations that pavement widening (runway from 45m to 60m and taxiways from 23m to 25m) may not be required, particularly for A 380 traffic.

Comments:

(i) The ICAO Circular referred to by the Consultant does not apply to new constructions or major redevelopment.

(ii) There is no evidence of ICAO having accepted the conclusions mentioned above by the Consultant.

(iii) **The issue is a master planning one having some cost implications and as such it warrants a decision from the State.**

(iv). To the question of stand for A 380 aircraft, the Consultant advised that one stand will be sized, probably at the corner of the Ramp, facing passenger terminal for the handling of (occasional) Code F aircraft. It is not clear from the Terminal Zoning Plans that such provision has been made. **Consultant is requested to clarify.**

Consultant answer or action:

i. *There is no plan today for operations of code F aircraft at New Goa International Airport. Assuming the airport being commissioned around 2010 with a traffic comprising aircraft under code letters B, C and E of Annex 14, the possible introduction of code F aircraft a few years later would be considered as occurring on an existing airport. In our view, the NLA ICAO circular would then be applicable.*
ii. *Basically, the above circular is providing guidance to the State regulator for dealing with NLA operations on existing airports. The decision will then be up to the Indian regulator.*
iii. *We totally agree that the matter is warrant a decision from the State*
iv. *Location of the potential A 380 stand will be shown on the airport layout plan as well as on Terminal Building Ground Floor Plan.*

Report Paragraph 3.5 (Second correspondence issued by ICAO, by July the 13th)

The Consultant's opinion given in his sub paragraphs (i) and (ii) are not endorsed by ICAO.

ICAO Circular 305 AN/177 – Operation of New Larger Aeroplanes at Existing Aerodromes was issued in the context of the airports that existed at the time of the applicability of the SARPS contained in Annex 14 to the Convention on International Civil Aviation, Volume 2 November 1999. The contents of this Circular were not intended to be applied to airports that did not exist in November 1999. Reference may be made to the following stipulation in paragraph 1.14 of Chapter 1 – Introduction of the Circular:

*"... **However facilities meeting Code F requirements should be provided, in full, on all relevant parts of the movement area whenever new construction or major redevelopment is undertaken.** When planning such construction or redevelopment, it may be prudent to consider the requirements of future aeroplane types needing facilities in excess of Code F. Guidance in this respect is given in the Aerodrome Design Manual (Doc 9157), Part I – Runways and Part 2 – Taxiways, Aprons and Holding Bays. **Long-Term perspective planning to cater to future needs and ability of the ground infrastructure to be modified quickly, without disruption of ground operation and without compromising safety, would be advisable."** (Bold fonts are introduced by us for the purpose of emphasis).*

As of now, therefore, the stated concept of post-construction aeronautical studies shall not apply to aerodromes planned or taken up for construction after November 1999 or major redevelopment of existing airport planned for implementation after that cut-off date.

The Consultant has very appropriately indeed taken Code F aircraft requirements for master planning purpose into account, for example in providing necessary clearances, aircraft stand positions etc. It is our considered view that provision of 25m wide straight taxiways 25m at this stage itself is in keeping with the objective of long-term perspective planning. Future construction work for the widening of taxiways from 23m to 25m in very narrow strips may not be practical, may disrupt operations and is likely to compromise safety of operations. Small additional expenditure at this stage will avoid the above problems and will, in addition add to the safety of Code F aircraft operations, even though occasional.

We are therefore of considered view that the airport plan should provide for 25m wide taxiways and the project cost reviewed. The consultant may even be able to identify possibilities of lowering other costs to accommodate this relatively small increase in the overall context of the project.

Final Decision after working sessions held in Goa by July 25-27, 2005, involving Goa Government, ICAO officials and Consultants Project Managers :

It has been decided to build taxiways and taxilanes complying with Code 4F requirements. The additional cost is rather low and moreover is justified by the complexity of widening taxiways from 23m to 25m under aeronautical operations. The increase of the investment cost reaches 330 000 USD, which is not significant compared to the total cost first phase of construction.
The runway will still however be of 45 m wide, as per Code 4E regulation.

SECTION 5: Final Traffic Forecasts

Paragraph 5.3.3 (Catchment's Area)

Observation:

(i) It has been suggested that due to congestion and limitations there may be some opportunity for diversion of traffic from Mumbai and Bangalore to Mopa.

Comments:

(i) This suggestion needs to be reviewed in the light of the fact that the new greenfield international airport for Bangalore is expected to be operational in not too distant future and to alleviate the congestion/ limitations at the existing Mumbai International Airport a proposal to construct a new airport at Navi Mumbai is in the pipeline (It is noted that later in the paragraph it has been assumed that significant additional airport capacity will have been developed for the Mumbai area prior to the year 2014 forecast prepared for Mopa).

Consultant answer or action:

i. *It is true that diversion of traffic from Bangalore or Hyderabad airport may occur only if the construction of these new PPP airports is significantly delayed.*
ii. *Regarding Mumbai, it is likely that heavy capacity constraints will develop in the near future : on one hand, extension of Chhatrapati Shivaji International Airport, only 750 ha wide and encroached by over 100 000 illegal settlers, will at least take time ; on the other hand, the new airport project at Navi Mumbai is not really in the pipeline and will also require construction of a major road and rail link across Mumbai harbour.*

Section 5: Final Traffic Forecasts (Second correspondence issued by ICAO, by July the 13th)

The Consultant's clarification regarding diversion of some traffic from Mumbai till the new planned second airport is constructed, would seem logical. It may however not be correct to say that New Mumbai International Airport project is not in the pipeline.
Regarding the impact of new airports at Hyderabad and Bangalore, the Final Report may reflect the possibility of diversion of traffic from there should the construction of these PPP airports is significantly delayed.

Final Decision after working sessions held in Goa by July 25-27, 2005, involving Goa Government, ICAO officials and Consultants Project Managers :

Due to the uncertainties about volume of diverted traffic and dates of opening of new PPP airports, it is assumed that no diversion of traffic will be taken into account.
In order to increase the traffic forecasts which have been assessed as conservative, it has been decided to increase the assumption made on Goa Region GDP by 1 %. (2004 statistical data: GDP = 10%, while it was assumed at 8, 5% in the Draft Final Report).
IATA also confirms that some new traffic routes and potential were to be integrated in forecasts in order to reflect the last impressive Boeing or Airbus aircraft purchases made by domestic careers.
Cargo forecasts shall be increased by 10%. Freight facilities requirements shall be adjusted accordingly.
The international Arrival or Departure peak hour shall also be increased so as to size the Terminal for the welcoming of B747 – Charter type – or NLA. The design of the Terminal shall be updated accordingly.

Paragraph 5.8 (Conclusions)

Observations: The Consultants have adopted a realistic and pragmatic approach in evaluation and analyses. The forecasts are termed by the Consultant as conservative.

SECTION 7: Airport Master Plan Layout

Comments: The location of Reserve Stands may be indicated and the item included in the Legend.

Consultant answer or action: *Reserve stands (2 in 2014, 5 in 2034) are located at each edge of passenger terminal apron in first phase and will be used as contact stand in further development of Passenger Terminal. Final Report layout plans will precisely indicate Reserve stands for short and long term. The Legend will also be amended accordingly.*

Paragraph 8.3.1: (Water Supply)

Observation:

(i) Concerning water source it has been assumed that water in adequate quantities will be made available to the site. Additionally it is assumed that tapping of ground water will not be required as it will require Government of India approval. The total quantity of water required at construction stage and at airport operational stage has not been estimated.

Comments:

(i) Consultant is requested to clarify the reasons why the above assumptions had to be made and is requested to include the above important information in the Final Report.

Consultant answer or action: *Consultant assessed the permanent water needs for the airport at various stages of development (1000 cubic meters/day – see 8.3.1), while temporary construction needs should be cared by the Contractor in charge of the first phase of construction of the airport, in accordance with the Conditions of Contract that will apply. On account of the permanent flow in nearby rivers, there is no doubt about water availability.*

Section 8: Project Identification for first Phase of construction

Paragraph 8.3.1 (Water supply)

Clear mention may be made in the Report that there is no doubt about water availability on account of permanent flow in nearby rivers, identifying the rivers, their distance from the airport site and how it will be conveyed to the airport including the required infrastructure and equipment. It may also be confirmed and indicated that the cost of these is included in the Project cost.

Paragraph 8.3.3: (Storm Water Drainage)

Comments:

The report does not identify the final outfall of the airport storm water beyond the rainwater harvesting ponds to be built of one day storage capacity at the peak rainfall intensity. Does water simply overflow the ponds and take natural course of flow?

Consultant answer or action:
Consultant assumed the water will overflow ponds and take natural course at least during the first period of operations (2014 – 2024).

Paragraph 8.4.3: (Power Supply)

Comments:

(i) Does the project bear the cost of power link to the proposed 11kV HV sub-station?

Consultant answer or action: *Yes, the cost of power link is included in "Connections to national network (Water, Power, Roads)"*

Paragraph 8.5: (IT & Telephone Concept Design)

Comments:

(i) Does the project bear the cost of connection to VSNL or equivalent national network?

Consultant answer or action: *Yes, the cost of connection to VSNL is included in "Connections to national network (Water, Power, Roads)"*

Paragraph 8.7: (Project Implementation Schedule)

Comments:

(i) The time allocated to Design/ Tendering/ Administrative, which includes the task of obtaining Government clearances (Ministry of Defence for air traffic conflict avoidance, Ministry of Environment and Forests for environmental clearance and Ministry of Civil Aviation for clearance and signing of concession agreement, etc) would seem inadequate considering the time taken in the case of other greenfield airport projects in the country.

(ii) Paragraph 12.3 describes the procedure for obtaining MOEF clearance that requires filing of an application supported by several documents such as Detailed Environment Impact Assessment Report, Environment Management Plan and details of public hearings.

(iii) In recognition of the urgency of the tasks, it is suggested that the State Government of Goa arranges consultancy for the preparation of the required Application for Environmental Clearance and another for air traffic conflict avoidance study in consultation with AAI on priority basis.

(iv) Given the multiple activities involved in the Design/ Tendering/ Administrative task, the Consultant may analyse the activities involved in greater detail and propose a much more detailed implementation schedule, more particularly for the Administrative tasks.

We suggest that the detailed Implementation Schedule be prepared in close consultation with the Government of Goa and AAI as the responsibility for most actions will rest with them. It will no doubt be kept in view that Kochi, Bangalore and Hyderabad airport projects being the early PPP projects most procedures may now be well established.

Consultant answer or action: *Consultant will review the duration of the various administrative tasks and detail their Content. Hyderabad and Bangalore greenfield projects will be used for benchmarking of Central and State Government administrative tasks.*
Adjusted project implementation schedule will be integrated in Final Report.

SECTION 10: Financial Analysis

Paragraph 10.2.2: (Results)

Paragraph 10.2.3 (Financing Options Assessment)

Observations:

(i) The airport will not generate enough cash flow to afford the projected capital investment programme.

(ii) Only three years after opening which is planned for 2010, the company will be able to generate revenues to cover the significant depreciation costs associated with the capital expenses programme.

(iii) The accumulated cash flow position will be positive only after year 2027. This implies that the project shall remain dependent on external sources until the year 2026, when the accumulated cash turns positive.

(iv) IRR is low at 4%, and therefore the project would not have a positive IRR for any discount rate above that value.

(v) Simulation of different options of structuring of transactions for construction and operation of the airport with least public sector intervention is now of crucial importance.

Consultant answer or action: *Option 1 (analysis of financing option) aims to define and evaluate the various financing possibilities. Consultant preliminary assessment is that some Public Sector participation will be necessary for the viability of the Project.*

SECTION 12: Environmental and Social Effect

Observation:

(i) While the preliminary assessment is positive, there is urgent need for preparation of a detailed analysis and detailed documentation to accompany Application for project clearance by the Ministry of Environment and Forests.

Consultant answer or action: *The Consultant concurs to the point that there is urgent need to start preparation of the various environmental applications.*

4. Applicable ICAO Standards and Regulations

The following documents have been used during the study.

Annexes to the Convention on International Civil Aviation

Annex 2	Rules of the Air	Annex 10	Aeronautical Telecommunications
Annex 3	Meteorological Service for International Air Navigation	Annex 11	Air Traffic Services
Annex 4	Aeronautical Charts	Annex 12	Search and Rescue
Annex 5	Units of Measurement to be Used in Air and Ground Operations	Annex 14	Aerodromes
Annex 6	Operation of Aircraft	Annex 15	Aeronautical Information Services
Annex 9	Facilitation	Annex 16	Environmental Protection
		Annex 17	Security: Safeguarding International Civil Aviation Against Acts of Unlawful Interference

The following documents have also been used:

- ICAO Aerodrome Design Manual Part 1 "Runways" second edition 1983,
- ICAO Aerodrome Design Manual Part 2 "Taxiways, Aprons and Holding Bays" second edition 1983,
- ICAO Aerodrome Design Manual Part 3 "Pavements" second edition 1983,
- ICAO Document 207-AN/126 – Simultaneous Operations on Instrument Runways
- ICAO Circular 305-AN/177 – Operations of New Larger Aeroplanes at Existing Aerodromes

IATA air terminal design criteria (described in Airport Development Reference Manual, ninth edition, 2004) will also be used as guidelines, associated with ADPi background and experience.

5. Final Traffic Forecasts

5.1. Introduction

IATA has produced a comprehensive traffic forecast for the proposed Mopa Airport in northern Goa. The forecast has been developed under the assumption that the Mopa facility will replace all commercial operations at the existing civil enclave at Dabolim Airport. The study provides an independent review of the available data and the corresponding estimation of the likely traffic development and growth at the new facility. The forecast takes into account a series of factors that are expected to condition both passenger and cargo traffic growth.

The forecast concentrates on three areas for the period 2005 – 2034:

- Traffic growth for both passengers and cargo;
- Growth in air traffic movements for both passenger and cargo aircraft, by type; and
- A busy day analysis for the forecast years 2014, 2024, and 2034.

As discussed in the inception report, an accurate traffic forecast for the Mopa Airport will be difficult. The aviation industry in general has experienced much turmoil in the last four years making it challenging to access the true rate of traffic growth. India itself is enjoying accelerated economic development and is experiencing considerable structural change in the airline sector. The current status of Dabolim as a civil enclave with both operational and capacity constraints, and no effective cargo facility, further compound the problem of determining a base from which to grow the demand. There are also questions with respect to the tourist carrying capacity of the state and the strategy of the tourist board to shift demand from beach tourism to historical, cultural, and ecological attractions.

In light of the above, IATA has taken a conservative approach to the preparation of the forecast. In order to measure the risk, we have prepared both optimistic, base, and pessimistic forecasts of the annual passenger and cargo traffic under various assumptions.

5.2. Information and Data Sources

A variety of qualitative and quantitative sources were used in preparation of the forecast. In the case of such a significant new development there is inevitably a reliance on the subjective opinions of industry experts and IATA has endeavoured to get as broad a perspective in this area as possible. The study also benefited from the considerable depth of data made available by the various government bodies within the state of Goa and by the Airports Authority of India (AAI) and its personnel in both Goa and Mumbai.

Information used in this study was drawn from:

- The Goa Department of Tourism, Tourist Master Plan and Tourist Statistics 2004.
- The 2001 – 2004 passenger and cargo statistics provided by Dabolim Airport Management.
- Annual and monthly passenger and cargo volumes for India and each Indian airport provided by AAI.
- Detail cargo volume information for Mumbai provided by AAI Cargo in Mumbai.
- The Government of Goa, Economic Survey 2003-2004.
- The Regional Plan For Goa, 2001.
- The IATA 2003 Passenger Forecast.
- The IATA 2002 Freight Forecast.
- The World of Civil Aviation 2003 – 2006, produced by ICAO.
- The Air Transport Action Groups 2000 Asia Pacific Air Traffic Forecast.
- Detailed and comprehensive schedule information available through the Official Airline Guide (OAG) for the period October 2004 through to February 2006.
- The 9th and 10th Five Year Plan prepared by the Planning Commission, Government of India.
- The Government of Goa, 2002, 2003, and 2004 budget speeches.

In addition IATA representatives met or otherwise conversed with representatives of:

- Air India, Indian Airlines, Jet Airways, Sahara Airlines, Gulf Air, and British Airways.
- Potential low cost start-up carrier SpiceJet.
- The Goa Department of Tourism.
- The Goa Chamber of Commerce.
- AAI management at Dabolim and Mumbai airport.
- The Goa Town & Country Planning Dept.

While detailed origin-destination data was not accessible for this study, IATA was able to develop a reasonable profile of the traffic based upon the information provided by the Department of Tourism and an analysis of the schedule and charter operations.

5.3. Forecast Assumptions

Traffic growth is determined by a combination of factors affecting both demand and capacity. To understand the potential variability of the forecast the following section discusses the assumptions in each of the major areas.

5.3.1. Economic Outlook

India

The India economy continues to be one of the fastest growing in the world. Annual GDP growth during the 1990's exceeded 6%. With a population growth slowing to less than 2%, real GDP per capita grew 4% per annum. In the last two years, the country has realised GDP growth of 7.4% and 6.5% (est.). The tenth five-year plan (2002 – 2007) has set the ambitious goal of 8% annual growth, and projects the same for the eleventh five-year plan.

The India economy is steadily shifting from one based on primary industry to one based on secondary and tertiary industry. Agriculture has fallen from 38% of the economy in 1980 to 25% in 2001 while the service sector has risen from 36% to 49% over the period. The reduced reliance on the primary sector will help to stabilize the economy and limit the effects of years where agriculture yields are reduced due to unfavourable weather conditions.

While India continues to suffer from a lack of industrial and network infrastructure, the IT sector has flourished. Information technology industries are less reliant of physical factors of production and have been able to take advantage of the educated workforce. With labour rates remain a fraction of those of the developed world, communication technology reducing distribution costs, and the world's growing appetite for information technology, the Indian IT sector will prosper and lead the countries economy.

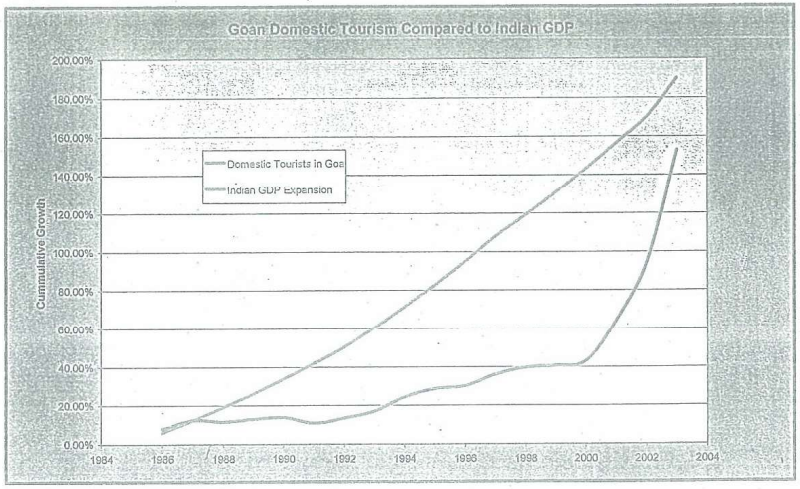
Recognizing that the economy has fallen slightly short of the objectives in the 10th five-year plan, we have assumed a 6.5% GDP growth for the next seven years followed by a return to the 5% growth the country has averaged over the last two decades. By 2034, these growth rates would result in a five-fold increase in GDP and at current rates of population growth, a three-fold increase in GDP per capita, bringing the economy to the level of a developed country. The government of India has established 2029 as the target for achieving developed country status.

State of Goa

The state of Goa is the most prosperous in India. At Rs 56,000 (2001), GDP per capita is more than double the national average. The rate of economic growth (8.7% per annum, 1993 – 2001) considerably exceeds that of the country in general and is amongst the highest of any state. Like the rest of the country, agriculture represents a declining share of the economy as tourism continues to grow and other industries (Pharmaceuticals and Information Technology) are beginning to flourish.

Within India, Goa is an attractive place for industry. It is ranked highest on the index of social and economic infrastructure. Its poverty ratio is 4.4% versus 26.1% for all of India and is one of the lowest rates of all Indian states. The literacy rate of 82.3% is the fourth highest and is 17% higher than the national average. Per capita expenditure on education is double the national average while healthcare expenditure is eighteen times the national average. With beautiful beaches, a rich history, more than adequate fresh water supply, a reliable power grid, an established transportation network, access to seaports, and a network of inland waterways, Goa offers both quality of life and economic advantages to businesses that locate there. The state has seen the output of the manufacturing sector grow by 13% per annum (1993-2001).

Not surprisingly, tourism remains a source of economic growth. Between 1993 and 2003 total tourist traffic to Goa increased by an annual average of 7.7%. Economic activity in the hospitality sector grew at an annualized 13.9% (1993-2001). The rate of tourist growth is even more striking when looking at the last four years which saw an average 21% increase in domestic tourists, significantly outstripping the growth of the domestic economy. Goa tourism is realizing the multiplicative effect of a growing Indian middle-class with increasing disposable income. The effects of the growing middle-class are demonstrated by the following graph comparing domestic tourism to Goa versus India GDP growth.



It should be noted, however, that the growth in the Indian economy is largely driven by the information technology sector, which is not a significant element of the Goa industrial base. While we expect Goa to out perform India, it must be noted that the states population density is above the national average, the Directorate of Planning and Statistics is predicting a slowing of population growth, and the tourist support industry is beginning to struggle to keep pace with the demand. With a GDP per capita already several times higher than national average, Goa simply doesn't have as far to go to reach developed world levels.

Given the relative strengths of Goa's economy, the increasing role of manufacturing, and the high rates of tourist growth, we have assumed the state's GDP will slightly outpace India in general until 2012 but will slow to the national rate for the balance of the planning period.

The table opposite lists the annual GDP growth assumed in the forecast.

Year	Estimated Real GDP Growth	
	India	Goa
2002	4.8%	6.3%
2003	7.4%	NA
2004	6.5%	NA
2005	6.5%	9.0%
2006	6.5%	8.7%
2007	6.5%	8.4%
2008	6.5%	8.1%
2009	6.5%	7.8%
2010	6.5%	7.5%
2011	6.5%	7.2%
2012	6.5%	6.9%
2013-2017	6.0%	6.0%
2018-2022	5.5%	5.5%
2023-2034	5.0%	5.0%

5.3.2. Airline Environment

In the last two years there has been a reversal in the yield increases traditionally observed in the Indian airline market. India has also seen the introduction of three low cost or lower price carriers and the launch of several other carriers is now imminent. These are significant changes, which, if they continue, will significantly increase air traffic volumes across the country.

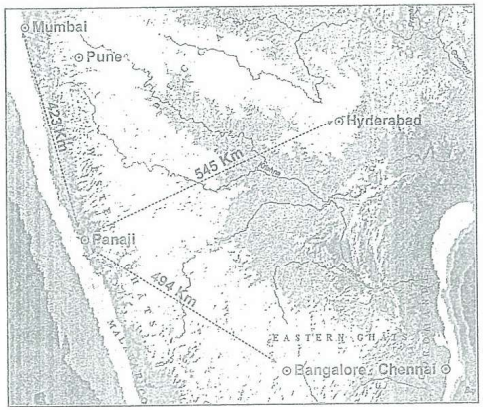
While global airline yields have been falling at the rate of 2% per year from 1985 to 2000, within India, domestic yields had been steadily increasing – at an estimated 4% annually. Over the same period Indian domestic travel still managed to grow at 4.5%. This, however, was not sufficient to keep up with the capacity growth associated with the launch of Jet Airways, Air Sahara, and most recently Air Deccan. Traffic contraction following the September 11th tragedy in 2001 and the SARS epidemic in 2003 resulted in surplus capacity and the need for the domestic carries to introduce discounted fares to stimulate demand. In 2004, traffic rebounded substantially, but largely as a result of the reduced prices.

The other significant change is the introduction, or imminent introduction, of three new carriers, Kingfisher Airlines, SpiceJet, and Air India Express, followed, potentially, by several other low cost carriers – Indigo, Air One, Paramount, Visaa, and Magic Air. Kingfisher Airlines, SpiceJet, and Air India Express operate varying degrees of a low-cost-carrier service with correspondingly reduced airfares. Indigo, Magic Air and Air One have both indicated their plan to follow the low-cost-carrier strategy.

The financial viability of the low cost carriers in the Indian market place remains to be proven. Their impact, however, will be significant and will entrench the trend towards lower yields that began in the last two years. Availability of affordable airfare will have considerable relevance for domestic tourism to Goa. It will reduce the dependence on road and rail transportation, which is a minimum day's journey from even the closest major centres. This will not only shift travel from other modes but should also stimulate demand as a result of the increased convenience.

5.3.3. Catchment Area

Goa is located near the focus of a semi-circle through Mumbai, Hyderabad and Bangalore. It is approximately one hour's flight time or twelve hours by road or rail from Goa to any of the three centres. There are no other significant commercial airports within a 500 Km radius from Goa. Where the local schedule offers the necessary availability, we expect most Goa originating or destined travellers would choose to fly from Mopa as opposed to travelling by ground transportation to board a flight from Mumbai, Hyderabad or Bangalore.



There is a need to assess the catchment area for Mopa versus the other airports. Congestion and limitations at Mumbai and Bangalore suggest that there may be some opportunity to divert traffic to Mopa. The congestion situation at other airports may also encourage one of the newer carriers to consider Mopa as a base for a hub operation.

Mumbai

Mumbai is India's busiest airport. It handles over 400 flights per day during the peak months and in 2004 accommodated more than 15 million passengers. It is rapidly becoming unable to meet the growing demand. The runway facilities are at, or near, full capacity during peak times of day, parking bays are increasingly scarce, the airport can accommodate no additional overnight aircraft, and the operating passenger terminals are at their design limits. It should be noted that congestion of the terminal areas is not, however, as limiting a concern. International terminal 2B is not currently being used and could be opened to address international travel requirements. Upgrades currently being carried out on the domestic terminals will increase their passenger processing efficiency and capacity.

The India Government has recently invited bids for the modernization and restructuring of Mumbai and Delhi airports. These are expensive projects estimated at INR 35 Billion and will presumably allow for considerable capacity expansion. We understand that increasing runway capacity at Mumbai airport is problematic because of the land shortage in such a populated urban area. Should the Mumbai modernization plans not support the necessary capacity, the demands of the economy and population base will require other solutions be found which may include expansion or development of nearby facilities. We have, therefore, assumed significant additional airport capacity will have been developed for the Mumbai area prior to the year 2014 forecast prepared for this study.

Hyderabad

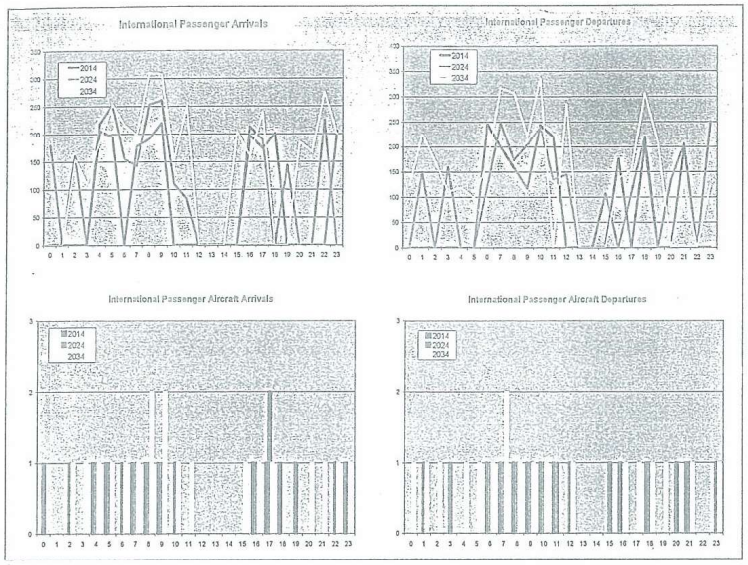
Hyderabad is India's sixth most active commercial airport. In 2004 the airport handled 2.6 million passengers and 33 thousand aircraft movements. While nominally, the airport is designated as a "Limited International" airport, there are scheduled international flights from Europe and the Middle East.

In March of 2005 work began on the development of new airport to serve the Hyderabad market. The airport is planned for completion in 2008 at which point the current airport will be closed for commercial operations. The new Hyderabad airport will have an initial capacity of 5 million passengers per year with plans to expand to accommodate up to 20 million. The expansive airfield is being designed to handle aircraft as large as the A380. Hyderabad will have full international designation and is aiming to serve as a connecting point for both domestic and international travel.

Bangalore

While Bangalore has a slightly smaller international operation than Hyderabad, overall it is the fifth busiest airport in India handling over 3.9 million passengers and 55 thousand flights in 2004. Like Hyderabad the airport is designated as a "Limited International" airport but does have some scheduled services operated by international carriers.

International Busy Day Demand Profile

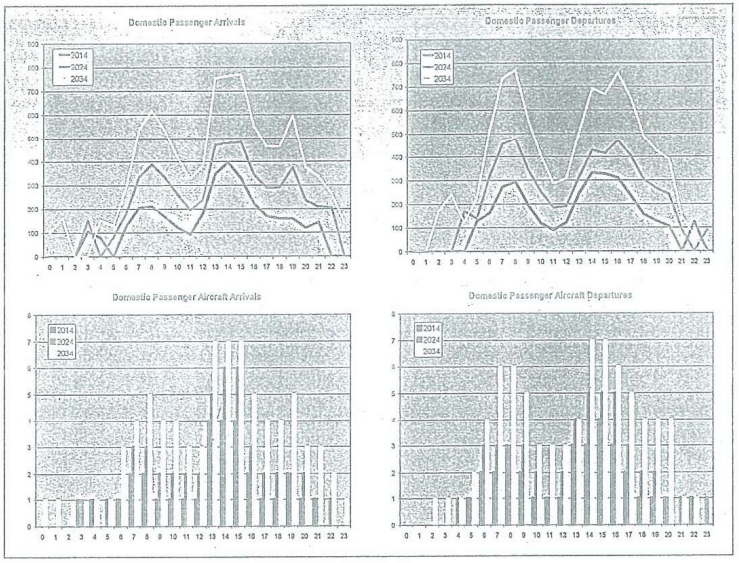


International passenger arrivals show a pronounced peak at 8:00 and a more extended peak in the evening period. Departures peak at 9:00 with a lesser peak at 18:00. The morning peaks are associated with the European flights and are consistent with the current operation albeit a little earlier as carriers take advantage of extended operating hours and parking availability. The profile of aircraft movements does not fluctuate to the same degree as the passenger profile because the peak period is served with larger gauge long-haul aircraft.

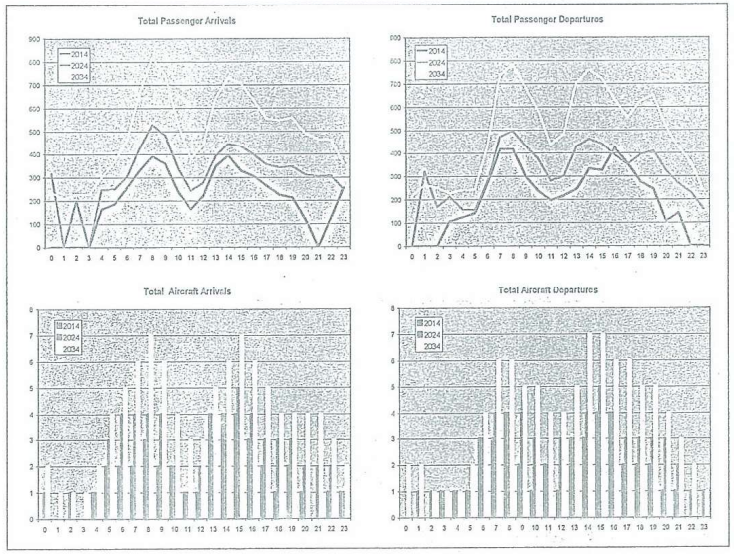
The level of operation may seem somewhat low but is consistent with the predicted widening of the peak period as opposed to an increase in peak frequency. As the schedules will no longer be driven by operational constraints at Dabolim they will evolve to meet the schedule efficiencies of the carriers and the requirements of the originating markets. The inter-meshing of schedules from numerous points will result in a more even flight distribution through the day.

The domestic arrival pattern shown below has a large mid-afternoon peak from 13:00 to 15:00 and two smaller peaks at 8:00 and 19:00. The departure schedule presents two pronounced peak periods from 7:00 to 8:00 and from 14:00 – 16:00. The peak travel times remain consistent with the current operation with a less pronounced mid-morning valley as carriers will no longer be limited by the constraints of a civil enclave and will use the morning availability as commercially required. The 2014 aircraft movement schedule still reflects to some degree, the historical Dabolim schedule as can be seen by the rapid increase in movements following the morning closure. The 2024 schedule does not show the same spike in the early afternoon.

Domestic Busy Day Demand Profile



Total Airport Busy Day Demand Profile



While much delayed since its initial announcement, new Bangalore airport is planned for completion in April 2008. Airport plans include two 4,000 metre runways and a phase I passenger capacity of 5 million. The airport will operate as a full international facility with anticipated operations from South East Asia, other South Asian countries, the Middle East, and Europe. Given the recent passenger growth at Bangalore (over 30% in 2004 and amongst the highest in the country), the airport may need to move rapidly to phase II to accommodate the growth requirements.

Mopa

For the purposes of the forecast, we have assumed that the new airport will be modern and efficient and designed to comfortably meet the passenger and cargo demands. We have assumed that the road and rail network will be improved to support convenient tourist access to the southern destinations and facilitate access from the catchment area. The airport will have the necessary facilities to support international traffic and will have full international designation.

Given the airport modernization and construction planned for the airports in the major surrounding centres, the forecast has not assumed a great deal of diversion from Mumbai, Hyderabad or Bangalore. While resolution of the capacity constraints at Mumbai is the most problematic, the capacity of Hyderabad and Bangalore will off-load some of the demand currently using Mumbai as a gateway to southern India. For the purposes of our forecast, we have limited the Catchment area to those Maharashtra and Karnataka talukas that fall within a 200 km radius from Mopa.

The location of the Mopa Airport will provide service to the southern Maharashtra talukas of:

- Sangli
- Sindhudurg
- Radnagiri
- Kolhapur

The new airport is very close to the border with Maharashtra and access to Mopa will be much more convenient than access to Mumbai. Mopa, however, will not offer the variety of schedule, choice of carriers, and connecting possibilities that are available through Mumbai. The talukas have lower GDP per capita than urbanized areas around Pune and Mumbai, and less than a quarter of the rates of the state of Goa in general. Sindhudurg is on the Arabian Sea and may offer some tourist potential in the future. The talukas represent an additional population base of some 8.7 million people.

With the planned improvement of NH17 – the north south national highway – the northern and eastern Karnataka talukas offer a potential catchment area. The relevant Karnataka talukas are:

- Belgaum
- Uttar Kannad
- Dharwad

The three talukas share GDP per capita similar to the southern Maharashtra regions and again considerably lower than that of Goa. The talukas have a combined population of 7.2 million.

We have based the potential traffic associated with the additional catchment area on the populations, the relative GDP per capita – with an adjustment for the accentuated relationship between GDP and air travel – and an appropriate discount for the more limited service versus the surrounding airports. As most of the traffic is inbound, the expanded catchment area does not dramatically influence the passenger traffic forecast. The incremental traffic is phased into the traffic forecast over three years starting in 2010 with the expected opening of the facility.

This catchment area, as a producer of perishable produce and other time sensitive goods, represents a significant airfreight opportunity. Whereas the current airport provides no material cargo facility, the development of Mopa will offer the area an entirely new service opportunity. Access to detailed production and shipping volumes by taluka for Maharashtra and Karnataka was not available and our estimates have been based on a proportional share of Mumbai and Bangalore cargo tonnage by type of traffic.

The potential of a carrier to develop a hub operation at Mopa is difficult to predict. With the new Bangalore and Hyderabad airports relatively close by, Mopa would not appear to offer a great deal of advantage. It is not as well located geographically and does not offer the consistent local demand to support the schedule frequency required to develop an effective connecting network. If, however, facility space in Bangalore or Hyderabad is inadequate for the numerous new carriers and the booming air travel market, it may be that by simply having appropriate capacity, Mopa becomes an attractive alternative for a carrier wishing to develop a hub in Southern India. Most of the new carriers, however, are planning to follow the low-cost-carrier model, which typically implies a point-to-point operation. The forecast, does not therefore, assume a significant carrier initiative to develop Mopa as a connection operation.

5.3.4. Tourist Infrastructure

Inbound tourism currently accounts for over 80% of the traffic at Dabolim airport. Over the range of the forecast, the reliance on inbound tourism is expected to diminish slowly but not to the point where tourism will no longer be the major traffic component. It is therefore prudent to recognize the very significant influence that the tourist capacity will have on the forecast of passenger demand. There is considerable evidence to suggest that tourist infrastructure capacity will become a limiting factor during the forecast period selected for this study.

A 1989 study by the state of Goa recommended a maximum hotel capacity of 46,000 beds in coastal areas. As of 2003 the state had a bed capacity of 34,914. While accommodation estimates by zone where not available, it is reasonable to expect that the majority of the current bed capacity is designed for the tourist requirements and is therefore located in the coastal areas. According to the Tourist Master Plan, the World Tourism Organization has estimated the carrying capacity for tourism in Goa to be 4.1 million. Goa enjoyed 2.5 million tourist arrivals in 2004.

Federal and state environmental laws have limits on the development of beach zones – the area from zero to 500 metres from the high tide mark. For areas that are not within a municipality, and are not in an environmentally sensitive area, construction can only occur 200 meters from the high tide mark. Additionally, new construction can be no more than 9 metres high, the footprint of the building can occupy no more than 25% of the land area, and the total floor space can be no more than 33% of the land area. While this policy will limit beachfront development, it has led to the development of very attractive and spacious resorts that rival any tourist destination in the world.