According to Mr. B.K. Sutaria, the former Chief Town Planner, there remain at least 15 kilometres of beachfront property suitable for resort construction. This is sufficient for between 5,000 and 10,000 additional beds. Beyond the 500 metre mark, more traditional zoning rules apply allowing considerable potential for second tier hotels.

As of 2003, Goa had an accommodation capacity of 17 guest beds per thousand visitors. This is considerable below the 22-beds-per-1000-tourists requirement suggested in the Tourist Master Plan. We have reviewed the bed requirement with a more narrowly defined peak definition but reflecting the shortening length-of-stay for foreign tourists and concur with the 22 beds per thousand visitors estimate. Note that this assumes a 95% occupancy rate during the peak December to January period and an 85% occupancy rate for the November to March period. These estimates are at the very limit of practical operations and highlight the current accommodation shortage.

Goa's reputation as premium resort destination continues to spread worldwide. Our observations of the southern beaches and resorts were extremely favourable. Currently, several major hotel and resort chains do not have properties in Goa and we anticipate that they will be moving to rectify the gap. Sheraton, Hilton, Four Seasons, Westin, and Club Med are amongst the hotel chains not represent.

During the period 1994 to 2000, accommodation grew from 17,500 to 30,600 beds – a rate of growth of 9.8%. From 2000 to 2003, the number of beds has risen to 34,900 representing a slower 4.5% annual increase. It may be that saturation of the northern beach area and more restrictive zone rulings are starting to slow down the rate of development. This was the opinion expressed by several of the representatives we met during our research in Goa.

The state Department of Tourism recognizes that beach tourism cannot forever accommodate increased growth and is working to promote other alternate tourist destinations and develop other attractions. These efforts will increase the attractiveness of Goa as a destination and will help to smooth the peaks and valleys in the current tourist seasons. While we anticipate the programs will have considerable success we do not believe that eco-tourism, adventure tourism, and archaeological and religious tourism will be sufficient to offset the loss of beach tourism should the corresponding infra-structure not keep pace with the demand. Although a growing segment, the demand for the "other" tourisms is small compared to the demand for beach resorts. While Goa maintains a unique and sustainable advantage with the reputation and beauty of its beaches and resorts, it competes with a broader base across India and Southeast Asia with respect to the other tourist opportunities it is pursuing.

Tourist capacity will continue to expand at the current 4.5% annual rate until the 4.1 million-tourist limit is reached. It would be foolish to assume that tourism would then remain stagnant. Demand will increase and tourism industry will find ways to meet that demand. It is, however, reasonable to expect that the rate of expansion will slow markedly and a more constrained 2% annual expansion of capacity has been assumed.

The current level of 17 beds per 1000 tourists is considerably lower than our calculations would suggest is required. While it is likely to be restricting peak season demand, this ratio has been the norm for the last decade and will, therefore, be used as the basis for extrapolating tourist capacity. At current rates of development the recommended 46,000 bed capacity limit will be reached in 2010. The 4.1 million maximum tourist capacity recommended by the World Tourist Organization would be reached by 2019 at the latest.

Tourist Accommodation Capacity		
Accommodation capacity multiple (beds/thousand)		17.1
Annual growth in tourist accommodation		4.5%
Annual growth in tourist accommodation, post target limit		2.0%
Year	Bed Availability	Tourist Capacity
2005	38,127	2,229,649
2006	39,843	2,330,000
2007	41,636	2,434,854
2008	43,510	2,544,444
2009	45,468	2,658,947
2010	47,514	2,778,596
2011	49,652	2,903,626
2012	51,886	3,034,269
2013	54,221	3,170,819
2014	56,661	3,313,509
2019	70,610	4,129,240
2024	77,959	4,559,006
2034	95,031	5,557,368

Recognizing that economic forces will drive up the price of accommodation as supply contracts, tourist arrivals by air are likely to be favoured versus other modes of travel. Presumably air travellers are less price-sensitive than those using road or rail and will be likely to accept the higher accommodation rates. Higher accommodation prices will tend to shorten the length-of-stay, making air travel a more attractive option. Internationally tourists who predominantly purchase package vacations will benefit from the bulk purchase rates and advance reservation of inventory. As a result we expect that capacity limits will have a lesser effect on air transport than on other modes. The forecasts produced in this study assume that tourist arrivals by air replace other modes of travel and are not constrained by accommodation limits. It should be noted that this is a fairly aggressive assumption. In 2004, 20% of visitors arrived by air. If the same ratio were to apply in 2034, the projected 95,000 beds would support only 1.1 million visitor arrivals by air.

The traffic impacts of the International Film Festival of India (IFFI) and the development of a convention centre have not been included in the forecast. While Goa will hopefully be frequent hosts to the Film Festival, it has not been established as a permanent venue. It would not therefore be prudent to speculate on the long-term impact. Similarly, the planned development of a convention centre has not been formalized and has not been included in the forecast. Both IFFI and the convention centre are important opportunities but their overall contribution to the projected demand would only represent a small percentage increase.

5.3.5. International Air Services Policy

As had been discussed in the inception report, the India government is increasingly pursuing a more liberal bilateral policy in order to meet the air travel demands of the Indian market. Forecasts provided in this report assume the necessary air services agreements are in place to support the demand requirements. This is consistent with the expectations associated with the private sector development of Hyderabad and Bangalore.

5.3.6. Incremental International Traffic

The current Dabolim civil enclave operates as a "Limited International" airport allowing scheduled international flights by Indian carriers and only charter flights by international carriers. Mopa would be designated an international airport and, subject to the assumed relaxation of bilateral policies, would be open to a far greater range of international services. IATA has been asked to consider the impact that this may have on the demand projections.

It is a challenge estimating demand for new services without a history of the base traffic from which to extrapolate. IATA has therefore chosen to be somewhat conservative in estimating the traffic potential. In an attempt to estimate the traffic potential the following information has been considered:

- The international tourist travel reported by the Department of Tourism compared to the international passenger arrivals reported by Dabolim.
- The international schedule traffic at Mumbai, Hyderabad, and Bangalore
- The tourist by country information collected by the Department of Tourism.
- Feedback from several airlines operating internationally to Goa.

Comparison of the total foreign tourist to the charter and international arrivals suggests that 80% of the foreign visitors arrive directly on international flights. Of the balance, it is reasonable to assume that some are visiting other India destinations. This leaves approximately 150 thousand foreign visitors flying to Goa via another India gateway. This is likely a diversified group that could not be easily shifted to direct service without an array of schedule alternatives serving many varied markets. The opportunity for incremental international traffic as a result of diversion from another India gateway are small and would be partially offset by a corresponding reduction in the number of passengers arriving on domestic flights.

Analysis of the country of origin information indicates most recorded tourist visitors are from European countries. The forecast model already takes into account growth in this area, which specifically addresses the European tourist market. These markets are long-haul and proportionately low demand and will grow only slowly to the level of year-round volume that warrants direct scheduled service. Discussions with representative of European carriers suggest that Mumbai, Bangalore, Chennai, and Hyderabad are areas of higher interest because of their more diversified traffic mix.

A review of the schedule operations to Mumbai, Bangalore, and Hyderabad suggest that services to the Middle East provides the greatest area of opportunity to Goa. This is primarily a result of the large Indian work force in the Gulf countries. Discussions with Indian based carriers indicate no immediate necessity to expand international service from Goa. Discussions with one Gulf carrier, however, suggest, that they would take advantage of any additional service opportunities to Southern India but this is partially a result of the current capacity and other limitations at Mumbai, Bangalore, and Hyderabad. As facilities in these areas become less restricted, the impetus for direct service to Goa diminishes somewhat. They did suggest, however, that there would be a potential for the development of local tourist traffic to Goa.

South East Asia represents the third largest share of air traffic to southern India (based on IATA regional groupings) but only a very small share of current Goa traffic. Despite the ranking, South East Asia – India traffic is relatively small compared to the industry as a whole and is more business than tourist driven. Mumbai for example, averages only six direct departures per day to South East Asian nations. Bangalore provides three, and Hyderabad between one and two.

The baseline growth rate used in forecasting international traffic is already several percentage points higher than the international average and ignores any capacity constraints with the current facility, prior to the new airport commencing operation in 2010. To some extent, therefore, a jump in international demand associated with new airport is built into the growth model.

IATA has built into the demand projections a specific increase, over the first 5 years of operation, of 100,000 international passengers. This is over and above the increases associated with the inflated growth rate. The forecast assumes approximately 30% of the incremental international traffic are passengers who would otherwise travel through another Indian gateway and arrive on a domestic operation.

5.4. *Current Traffic and Airport Volumes*

5.4.1. Historical Traffic Volume by Market

Based upon data provided by the Dabolim AAI, the Government of Goa Department of Tourism and by evaluation of the OAG schedule data and the input from the operating airlines, we have prepared the following summary and estimate of the traffic by segment.

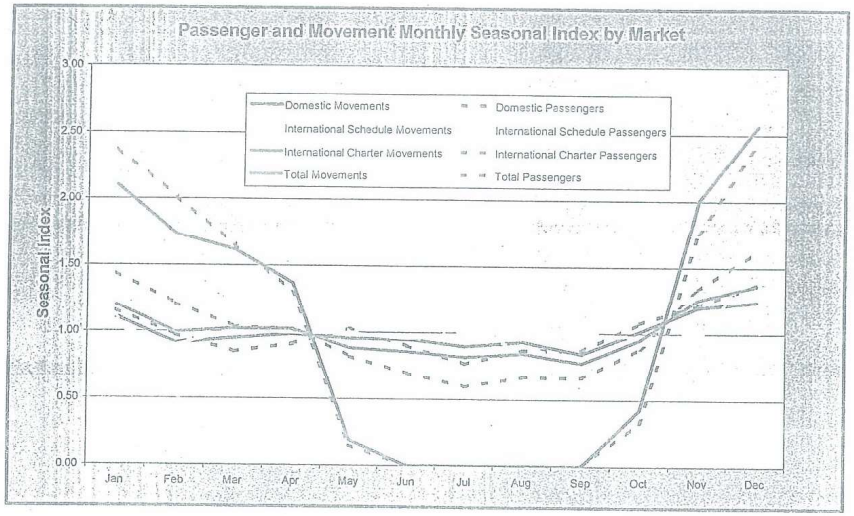
Summary of Annual Commercial Traffic at Dabolim Airport

	2000	2001		2002		2003		2004		
	Volume	Volume	% Chg.	Volume	% Chg.	Volume	% Chg.	Volume	% Chg.	% Distr.
Passengers										
Domestic	599,759	594,301	-0.9%	616,060	3.7%	666,088	8.1%	866,631	30.1%	72.8%
Int'l - Scheduled	38,647	38,324	-0.8%	30,111	-21.4%	37,073	23.1%	45,162	21.8%	3.8%
Int'l - Charter	200,115	208,821	4.4%	156,472	-25.1%	206,991	32.3%	278,424	34.5%	23.4%
Total	838,521	841,446	0.3%	802,643	-4.6%	910,152	13.4%	1,190,217	30.8%	
Cargo (Tonnes)										
Domestic	3,329	2,673	-19.7%	2,299	-14.0%	2,442	6.2%	3,302	35.2%	68.6%
Int'l - Scheduled	596	749	25.7%	750	0.0%	1,012	35.0%	743	-26.6%	15.5%
Int'l - Charter	28	0	-100.0%	123	0.0%	542	338.8%	765	41.3%	15.9%
Total	3,952	3,422	-13.4%	3,172	-7.3%	3,995	25.9%	4,810	20.4%	
Movements										
Domestic	6,550	6,348	-3.1%	7,382	16.3%	8,264	11.9%	10,088	22.1%	80.1%
Int'l - Scheduled	533	806	51.2%	952	18.1%	1,162	22.1%	1,256	8.1%	10.0%
Int'l - Charter	826	756	-8.5%	632	-16.4%	856	35.4%	1,246	45.6%	9.9%
Total	7,909	7,910	0.0%	8,966	13.4%	10,282	14.7%	12,590	22.4%	

Of the 1.2 million passengers using the airport in 2004, 73% were on domestic flights. Of the international traffic 84% travelled on charter operations. The concentration of international travel on charter flights underscores the seasonality of the international market with 94% of the international travel occurring in the six months during which the charters operate. The relatively large share of cargo moving on international charters despite the short operating season suggests considerable market potential for cargo services to the European markets.

5.4.2. Seasonal Demand Pattern

The following graph demonstrates the extreme seasonality of the Goa market.



In the above chart, the dashed lines indicate the passenger indices while the solid lines are representative of the aircraft movements. The indices represent the number of passengers or movements (adjusted for the number of days in the month) as a ratio of the annual monthly average. As would be expected, the passenger index is more volatile than the movement index. Obviously the charter traffic, which occurs only in the October to April season exhibits the greatest seasonality. While not of the same magnitude, there is still a similar and pronounced seasonal trend within both the domestic and international scheduled services. This graph should be analysed carefully, due to existing restrictions on International regular services at Dabolim.

5.4.3. Traffic Segmentation

There is a lack of hard data with which to segment the market into the appropriate components. We have therefore had to rely on the subjective estimates of the industry experts to whom we interviewed. In order to apply the relevant growth assumptions it was necessary to estimate the share of business and leisure travel, the share of resident and visitor traffic and the share of domestic arrivals that are actually international passengers.

Distribution of Traffic by Segment and Origin								
	Residents			Visitors			Business	Leisure
	Business	Leisure	Total	Business	Leisure	Total		
Domestic	30.0%	70.0%	20.0%	15%	85%	80.0%	18.0%	82.0%
International - Schedule	25.0%	75.0%	20.0%	10.0%	90%	80.0%	13.0%	87.0%
International - Charter	na	na	na	0.0%	100.0%	100.0%	0.0%	100.0%
Total	29.8%	70.2%	15.0%	11.3%	88.7%	85.0%	14.1%	85.9%

The 20% resident share of traffic may appear somewhat high but these estimates are observationally supported by the year round increased loads on the Friday morning domestic departures and Sunday evening returns. This traffic pattern is indicative of a Goa customer base making weekend or one-week vacations to Mumbai, Delhi, Bangalore, etc. The resident share of the international schedule market is composed of predominantly outbound migrant workers. This group also makes up the major component of the business estimate on the scheduled international flights.

The foreign tourist information was used to help determine the portion of domestic passengers who originated from a foreign destination. In order to do this we had to make an assumption as to what percentage of foreign tourist arrived by air as opposed to road, rail, and cruise. Cruise ship arrivals were provided by the Department of Tourism. From the total foreign tourist we subtracted the portion that arrive on international schedule and charter flights as well as the cruise ship arrivals. Of the remainder we assumed that 80% arrived by air. It is assumed that the majority of foreign tourists would be time conscious and would not want to travel via road and rail – ground transportation takes 12 hours from Mumbai, Hyderabad, or Bangalore. This led to an estimate of 146 thousand foreign tourists arriving on domestic flights.

5.4.4. Aircraft Movements

Based upon the October 2004 OAG and the most recent charter schedule provided by AAI Dabolim, 14,592 aircraft movements are expected for the period October 2004 to September 2005. Of these most are in the 50 to 100 metric ton category representative of the B737 and A32X aircraft used by the domestic carriers. The Category 5 (200 – 400 ton) aircraft are the A330 and Il-96 aircraft used by the charter operators.

Aircraft Movements (Oct. 2004- Sept. 2005)				
MTOW Category	Domestic	International		Total
		Schedule	Charter	
0 (0 to 10 tonnes)				-
1 (10 - 20 tonnes)	1,232			1,232
2 (20 - 50 tonnes)	714			714
3 (50 - 100 tonnes)	10,032	227	20	10,279
4 (100 - 200 tonnes)	878	417	702	1,997
5 (200 - 400 tonnes)			370	370
6 (> 400 tonnes)				-
Total	12,856	644	1,092	14,592

5.5. Annual Forecast

5.5.1. Passenger Forecast

The passenger forecast was calculated using an average of various estimates provided by IATA, ICAO, airline representatives, the Government of India Planning Commission, the Centre for Asia Pacific Aviation, and our own extrapolation of domestic travel growth. We addressed the potential increase in catchment area and considered the impact of connecting traffic. We also assumed that the current Dabolim airport is capable of handling the expected growth, until such times as the Mopa facility comes online.

Growth Projections

The IATA 2003 Passenger Forecast estimates worldwide international airline traffic will grow by 5% per annum until 2007 followed by growth of 4.4% from 2008 to 2012 and 4.2% from 2012 to 2018. It notes a 6.2% annual average passenger growth from 1985 to 2002. The forecast for domestic India traffic was 6.4% from 2003 to 2007. . In ICAO's "The World of Civil Aviation – 2003-2006" report, world passenger traffic, measured in revenue-passenger-kilometres, is forecast to grow 5.4% and 5.2% for 2005 and 2006 respectively. ICAO forecasts Asia/Pacific traffic to grow 6.8% and 6.4% over the same period. It should be noted, however, that at the time of the forecast the industry was feeling the effects of the second Iraq war and the SARS epidemic. At the time the forecasts were prepared, neither organization had opportunity to observe the change in domestic pricing practices that began in 2003 and became more wide spread in 2004. In our view, the earlier IATA domestic forecast was considerably understated. As was previously, in response to these price initiatives and following a period of suppressed demand, domestic travel grew 25% in 2004.

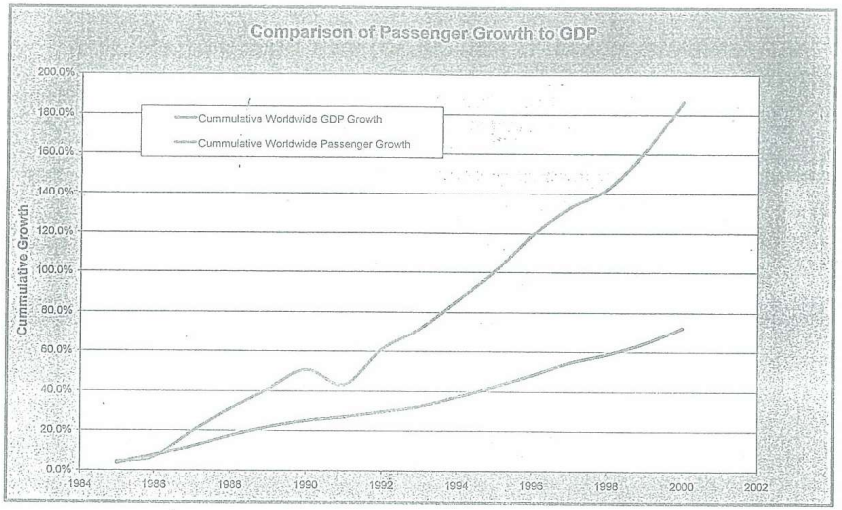
IATA's forecast for International traffic between India and the major relevant world regions are given bellow.

Forecast Passenger Growth Between India and the World's Regions				
Region	2004	2005	2006	2007
Middle East	6.0%	6.9%	5.9%	5.2%
North America	6.0%	6.0%	5.0%	5.0%
North East Asia	15.1%	11.2%	9.7%	9.5%
Other South Asia	3.4%	6.3%	4.4%	3.1%
South East Asia	9.6%	8.7%	8.3%	8.2%
Western Europe	6.2%	5.6%	5.0%	4.5%

While the most significant growth is projected to be between India and North East Asia, current tourist statistics suggest there is basically nil traffic between the market and Goa. Our forecast will largely be based upon the Middle East and Western Europe projections as these markets represent the vast majority of the international travel.

While not as detailed in their traffic projection we have considered the estimates provided by the World Tourism and Travel Council (WTTC) and the Centre for Asia Pacific Aviation (CAPA). The World Tourism and Travel Council has forecast tourist growth to India will grow by 8.8% per annum between 2005 and 2014. The Centre for Asia Pacific Aviation has proposed the most bullish of all forecasts with domestic growth estimated at 20% per annum for the next ten years. They have forecast international travel growth at between 12% and 15% over the period.

In developing the forecast we have looked at the long term relationship between air travel and GDP. A regression of annual changes in passenger air travel versus worldwide GDP suggests a relationship of two to one, though with a weak correlation. On a year-to-year basis the relationship is not robust. Over a prolonged period, however, the trend, as shown in the attached chart is very pronounced.



Between, the years 1985 and 2000 worldwide passenger volumes grew at double the rate of global GDP. During the same time, passenger yields fell 2% per annum in current dollar terms and close to 4.5% in real value. As previously mentioned, India's airline traffic grew at approximately 4.5% per year during this period – two percentage points below the rate of GDP expansion. India, however, did not experience the same collapse in yields that have continually challenged the balance of the world's carriers.

This pattern now seems to be reversing. We have several times in this document mentioned the introduction of low-cost carriers. The experiment with advance purchase discounts that began in late 2003 has demonstrated the huge demand stimulation that it is achievable. We have conservatively estimated annual traffic growth at 1.5% above the rate of real GDP growth. This estimate puts us very much in line with the planning estimates of the airlines we met and contacted.

Year	IATA		WTTC	CAPA		GDP	GDP+1.5%		Aggregate	
	Domestic	Int'l	Int'l	Domestic	Int'l		Domestic	Int'l	Domestic	Int'l
2005	7.1%	6.3%	8.8%	20.0%	12.0%	7.2%	8.7%	6.6%	9.8%	7.6%
2006	6.2%	5.5%	8.8%	20.0%	12.0%	7.2%	8.7%	5.9%	9.5%	7.4%
2007	5.7%	4.9%	8.8%	20.0%	12.0%	7.1%	8.6%	5.4%	9.3%	7.0%
2008	3.4%	4.3%	8.8%	20.0%	12.0%	7.1%	8.6%	4.9%	8.5%	6.7%
2009	3.4%	4.3%	8.8%	20.0%	12.0%	7.0%	8.5%	4.9%	8.4%	6.7%
2010	3.4%	4.3%	8.8%	20.0%	12.0%	7.0%	8.5%	4.9%	8.4%	6.7%
2011	3.4%	4.3%	8.8%	20.0%	12.0%	6.9%	8.4%	4.9%	8.4%	6.7%
2012	3.4%	4.3%	8.8%	20.0%	12.0%	6.8%	8.3%	4.9%	8.3%	6.7%
2013	3.5%	4.1%	8.8%	20.0%	12.0%	6.1%	7.6%	4.6%	8.0%	6.6%
2014	3.5%	4.1%	8.8%	20.0%	12.0%	6.0%	7.5%	4.6%	8.0%	6.6%
2015	3.5%	4.1%				6.0%	7.5%	4.6%	5.5%	4.5%
2016	3.5%	4.1%				6.0%	7.5%	4.6%	5.5%	4.5%
2017	3.5%	4.1%				6.0%	7.5%	4.6%	5.5%	4.5%
2018	3.5%	4.1%				5.5%	7.0%	4.5%	5.3%	4.4%
2019	3.5%	4.1%				5.5%	7.0%	4.5%	5.3%	4.4%
2020	3.5%	4.1%				5.5%	7.0%	4.5%	5.3%	4.4%
2021	3.5%	4.1%				5.5%	7.0%	4.5%	5.3%	4.4%
2022	3.5%	4.1%				5.5%	7.0%	4.5%	5.3%	4.4%
2023	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2024	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2025	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2026	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2027	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2028	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2029	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2030	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2031	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2032	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2033	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%
2034	3.5%	4.1%				5.0%	6.5%	4.5%	5.0%	4.4%

The aggregate forecast is a weight average of the IATA, WTTC, CAPA, and GDP based forecasts, with the highest weight given to the GDP based and IATA derived forecasts.

In addition to the projected growth shown in the above table, we have provide a significant jump in the 2005 demand to reflect the rapid year-over-year growth currently being observed in both domestic and international travel to India. Goa airport has seen a considerable 19% increase in the first four months of 2005. We have extrapolated this increase for the balance of the year. For the purposes of this study, however, we have assumed long-term demand growth will return to the rates shown in the above table. The current growth is very much being driven by falling prices that are below break even levels and cannot be sustained over the long-term. In the near-term, the airport infrastructure does not have the capacity to support a continuation the observed 2004 and 2005 traffic growth rates.

While not specifically included in our air traffic forecast, we did study in detail the tourist traffic projections developed for the 2001 Tourist Master Plan for Goa. The projections were based on information prepared for the 9th Five Year Plan (1997 – 2002) and available Goa tourist traffic information from 1990 to 1998. The study predicted a linear growth of approximately 25,000 domestic and 25,000 international tourists per year. This estimate was further supplemented by another 15% due to the benefit of initiatives in the plan.

As the starting point for international tourist is one-third that of domestic tourists, growth rate from 1998 to 2021 equates to an annual 2.63% for domestic versus 6.53% for international. This is much less than the growth estimates we have assumed and contrary to our projected higher domestic growth. Based on the Tourist Master Plan projections, the state would have expected 1,206,350 domestic and 449,650 foreign tourists in 2003. According to the 2004 tourist statistics handbook, the state actually experiences 1,725,140 and 314,357 domestic and international tourists respectively in 2003. The overall growth rate was considerably more than projected and reflected a much stronger domestic component.

At the time the projections for the tourist master plans were being developed, the authors did not have the benefit of the higher domestic growth projections now used for India. As domestic tourism has already achieved levels the master plan had not predicted until 2021, we felt we had to discount the value of these estimates regardless of their sensibility at the time they were prepared.

Passenger Forecast Methodology

In order to apply the growth projections appropriately, the estimated traffic distribution was used to segment the market volumes into resident versus non-resident and business versus leisure. The international tourist volumes were analysed in comparison to the international arrivals to estimate the volume of international passengers on domestic flights. The impact of the expanded catchment area was added to the resident traffic share and to a lesser extent to the domestic non-resident traffic. We have made the assumption that non-resident international traffic is predominantly tourists destined to Goa and won't be significantly affected by the expanded catchment area. The appropriate growth projections were then applied to the relevant market segments

This provided a base forecast to which we then added traffic to reflect the introduction of new services associated with the expanded international access. Using the time of day arrival and departure pattern developed for the busy day forecast the connection potential was examined for international-to-domestic, domestic-to-domestic, and international-to-international services. This enabled a sensible estimation of incremental connecting traffic.

Annual Traffic Forecast

As the following table indicates, the 2014, 2024, and 2034 passenger forecast are 2.8 million, 4.6 million and 7.3 million respectively. This equates to annualized growth rate of 8.2%, 6.5%, and 6.0% for each of the three periods. Total domestic passengers are forecast to grow to 2.1 million at an average annual rate of 7.4% between 2005 and 2014. Estimated domestic passengers of 3.4 million and 5.6 million in 2024 and 2034 represent a 6.7% and 6.2% annualized growth rates. The "Int'l" column in the domestic section of the table indicates those international passengers traveling via domestic services from another international gateway within India. International passengers of 0.8 million, 1.1 million, and 1.7 million in 2014, 2024, and 2034 represent annualize growth rates of 7.8%, 5.9% and 5.2% respectively.

Passenger Forecast

Year	Domestic				International			Grand Total
	Int'l	Business	Leisure	Total	Business	Leisure	Total	
2005	173,749	245,654	573,193	992,596	6,865	377,667	384,532	1,377,128
2006	186,519	268,979	627,618	1,083,116	7,425	405,591	413,016	1,496,132
2007	199,634	293,981	685,955	1,179,570	8,010	434,300	442,310	1,621,880
2008	213,087	318,866	744,021	1,275,974	8,603	463,726	472,329	1,748,303
2009	227,438	345,779	806,816	1,380,033	9,239	495,128	504,368	1,884,401
2010	244,794	374,876	874,710	1,494,380	11,790	531,180	542,970	2,037,350
2011	265,905	406,234	947,879	1,620,019	14,770	574,984	589,754	2,209,772
2012	291,475	440,013	1,026,696	1,758,183	18,299	627,947	646,245	2,404,429
2013	316,141	475,324	1,109,088	1,900,553	22,174	678,680	700,853	2,601,406
2014	339,709	513,231	1,197,538	2,050,478	26,374	726,831	753,205	2,803,683
2024	511,428	871,283	2,032,991	3,415,702	72,372	1,065,691	1,138,063	4,553,765
2034	745,256	1,465,858	3,420,331	5,631,445	137,013	1,529,577	1,666,590	7,298,034

Distribution of Connecting Passengers

The distribution of connecting traffic by market type is presented in the following table. Overall connecting volumes are relatively small reflecting the assumptions with respect to the slim likelihood that Mopa will be developed as a hub operation. This is also consistent with the presumably superior connection opportunities available through Mumbai, Bangalore, and Hyderabad. Flow traffic will be minimal until the schedule frequency builds sufficiently to support efficient connection opportunities.

Local Versus Connection Traffic

Year	Local		Int'l To Int'l	Int'l To Dom.	Dom. To Dom.	Total
	Int'l	Dom.				
2014	753,205	2,050,478	0	0	0	2,803,683
2024	1,123,923	3,364,188	5,859	16,563	43,233	4,553,765
2034	1,586,792	5,324,414	32,326	94,944	259,559	7,298,034

Connecting traffic represents only a 5.3% of the total passenger volume forecast for 2034.

Passenger Profile

Approximately 85% of the projected passengers are visitors versus 15% residents. This is largely unchanged from the estimated current passenger distribution. The split between business and leisure, however, is projected to shift quite significantly in favour of business travel with the percentage of business travel climbing from 14% to 23%. The share of business traffic is predicted to remain stable on domestic sectors with the major increases occurring on the regional international flights, and to a lesser degree on the long-haul international flights.

Passenger Profile (000's)

	2014				2024				2034			
	Business	Non-Business	Total	% Dist	Business	Non-Business	Total	% Dist	Business	Non-Business	Total	% Dist
Domestic												
Visitors	444.6	1,263.8	1,708.3	83.3%	748.2	2,086.7	2,834.8	83.0%	1,247.2	3,407.0	4,654.2	82.6%
Residents	102.6	239.5	342.2	16.7%	174.3	406.6	580.9	17.0%	293.2	684.1	977.2	17.4%
Total	547.2	1,503.3	2,050.5		922.4	2,493.3	3,415.7		1,540.4	4,091.1	5,631.4	
% Dist	26.7%	73.3%			27.0%	73.0%			27.4%	72.6%		
International - Regional												
Visitors	14.3	225.0	239.3	96.7%	45.0	399.7	444.7	95.8%	79.1	670.2	749.3	95.5%
Residents	1.8	6.5	8.3	3.3%	3.7	15.6	19.3	4.2%	7.2	28.3	35.5	4.5%
Total	16.1	231.5	247.6		48.7	415.3	464.0		86.3	698.5	784.8	
% Dist	6.5%	93.5%			10.5%	89.5%			11.0%	89.0%		
International - Long Haul												
Visitors	6.7	485.8	492.5	97.4%	18.3	638.7	657.0	97.5%	42.6	813.5	856.1	97.1%
Residents	3.6	9.6	13.2	2.6%	5.4	11.7	17.1	2.5%	8.1	17.6	25.7	2.9%
Total	10.3	495.3	505.6		23.7	650.4	674.1		50.7	831.1	881.8	
% Dist	2.0%	98.0%			3.5%	96.5%			5.7%	94.3%		
International - Total												
Vistors	21.0	710.7	731.8	97.2%	63.3	1,038.4	1,101.7	96.8%	121.7	1,483.6	1,605.3	96.3%
Residents	5.4	16.1	21.4	2.8%	9.1	27.3	36.4	3.2%	15.3	45.9	61.2	3.7%
Total	26.4	726.8	753.2		72.4	1,065.7	1,138.1		137.0	1,529.6	1,666.6	
% Dist	3.5%	96.5%			6.4%	93.6%			8.2%	91.8%		
Grand Total												
Vistors	465.6	1,974.5	2,440.1	87.0%	811.4	3,125.1	3,936.5	86.4%	1,368.9	4,890.6	6,259.6	85.8%
Residents	108.0	255.6	363.6	13.0%	183.4	433.9	617.3	13.6%	308.5	730.0	1,038.5	14.2%
Total	573.6	2,230.1	2,803.7		994.8	3,559.0	4,553.8		1,677.4	5,620.6	7,298.0	
% Dist	20.5%	79.5%			21.8%	78.2%			23.0%	77.0%		

Regional international flights have been defined as flights between India and Africa, the Middle East, South Asia, and South East Asia. Long-haul flights are those to Europe, North East Asia, and the South Pacific. Flights to North America were not considered as an opportunity for Goa. The following table provides a detailed forecast by world region. The regional distribution has been estimated through an analysis of the traffic patterns of the surrounding airports, an assessment of the long range European charter potential, and consideration of the IATA regional forecasts for traffic from India. Traffic to the Middle East is the fastest growing segment, with this region accounting for 32% of passengers by 2034. The South East Asian region is expected to become a material destination, while the relative importance of Europe is expected to decline considerably but remain the most dominant share accounting for 49% of the traffic in 2034.

Passengers By World Region

	2005	2014	2024	2034
Africa	0	7,080	16,160	22,499
Central Asia	0	0	0	0
Europe	319,546	505,626	647,102	821,962
Middle East	62,025	176,777	329,128	538,142
North East Asia	0	0	16,160	37,332
South Asia	0	31,861	48,595	74,663
South East Asia	2,961	31,861	70,105	149,493
South Pacific	0	0	10,812	22,499

For purposes of comparison the following table presents an estimate of the passenger forecast for all of India. The data is based upon information made available by the Airports Authority of India. The growth rates used in the India forecast are adjusted for the slightly lower rate of economic growth expected for the country versus Goa. A marginally lower rate is applied in the later years of the plan reflecting the potential airport capacity problems that a one billion passenger a year market will generate. Our forecasts suggest that Goa will grow its share of the Indian passenger travel market from 0.67% to 0.73% in 2034. The domestic share will grow from 0.73% to 0.80% and the international share from 0.50% to 0.54%.

India and Goa Comparitive Forecast									
	Passenger (000's)								
Year	Goa			Rest of India			All India		
	Domestic	Int'l	Total	Domestic	Int'l	Total	Domestic	Int'l	Total
2005	993	385	1,377	133,833	69,033	202,866	134,826	69,418	204,244
2014	2,050	753	2,804	258,393	124,365	382,758	260,443	125,118	385,562
2024	3,416	1,138	4,554	430,811	196,700	627,512	434,227	197,838	632,065
2034	5,631	1,667	7,298	701,679	293,160	994,838	707,310	294,826	1,002,136

5.5.2. Cargo Forecast

The forecast of cargo potential has been heavily based upon the trends identified in IATA's 2003 Freight Forecast. While that forecast covered only the 2003 – 2007 period, it clearly identifies a strong and growing demand for air-freight within India and between India and Europe, the Middle East and South East Asia. The forecast also reports the worldwide historical air cargo traffic trend, which achieved an average annual growth of 7.4% from 1985 to 2002. This is a full 2.4 percentage points stronger than the passenger demand during the same period. India in particular, with a need to move a great volume of perishable goods but with a congested and older road and rail infra-structure will continue to see very high rates of cargo traffic growth as the economy continues to sustain above average economic development. For the country in general we have estimated a continuation of the 7.2% and 7.4% domestic and international growth that was forecast by IATA for the 2003 to 2007 period.

We recognize that the current Dabolim airport is not setup to handle cargo traffic and lacks the appropriate facilities. We have therefore limited domestic cargo growth to 1% and international cargo growth to the rate of expansion of international service. As international cargo currently represents only 30% of the cargo traffic we felt that even with the limited facilities there remained room for growth in this area. Effective 2010, with the assumption that the Mopa facility is operational and has the appropriate physical plant, we are projecting the higher levels of cargo growth suggested in previous paragraph.

We also met with the AAI Cargo management in Mumbai airport and collected data with respect to their cargo operation. In the discussions they confirmed that the Karnataka and Maharashtra talukas identified in the catchment area, as well as the state of Goa, itself, are a significant source of both inbound and outbound cargo traffic. We have assumed that a proportionate share of the Mumbai cargo traffic would shift to Mopa. We are projecting 50% of the share by population of the pharmaceutical and perishable-good traffic would move to Mopa. With respect to the other cargo goods, we have estimated 25% of the share by population would shift to the new airport. This traffic is phased in between 2010 and 2012.

The above projections lead to the cargo volume and freighter movement estimates presented below.

Forecast Air Freight Volumes (Metric Tonnes)										
Year	Domestic			International			Grand	Freighter Movements		
	Loaded	Unloaded	Total	Loaded	Unloaded	Total	Total	Domestic	Int'l	Total
2005	1,312	2,023	3,335	927	667	1,594	4,929	0	0	0
2006	1,325	2,043	3,368	979	706	1,685	5,053	0	0	0
2007	1,338	2,063	3,402	1,035	746	1,781	5,183	0	0	0
2008	1,352	2,084	3,436	1,094	788	1,883	5,318	0	0	0
2009	2,534	2,641	5,175	2,326	1,369	3,695	8,871	0	0	0
2010	3,815	3,228	7,043	3,658	1,983	5,641	12,684	0	0	0
2011	3,829	3,249	7,078	3,728	2,033	5,761	12,839	0	0	0
2012	5,253	3,885	9,139	5,212	2,701	7,913	17,052	16	14	30
2013	5,637	4,166	9,803	5,596	2,899	8,494	18,298	24	21	45
2014	6,048	4,468	10,516	6,007	3,111	9,118	19,635	34	28	62
2024	11,541	8,423	19,964	11,571	5,958	17,530	37,493	205	175	380
2034	21,184	15,216	36,400	21,503	10,992	32,495	68,896	530	454	984

Total cargo tonnage is forecast to grow at annualized rate of 19.5%, 11.8%, and 9.9% over the periods 2014, 2024, and 2034. International tonnage is estimated to grow by 22.4%, 14.0%, and 11.3% compared to a slightly slower 14.5%, 10.4%, and 9.0% for domestic cargo traffic.

Freighter movements were calculated by examining the current freighter operations at both Mumbai, and Bangalore. In Mumbai, the average freighter operation has a MTOW of 193 metric tonnes and a payload capacity of 55 tons. In Bangalore, the freighter operations use a smaller aircraft with an average MTOW of 132 tonnes and an average payload capacity of 38 tons. For the purposes of our calculations we have chosen an average of the two payload capacities – 46 tonnes. At a 60% weight load factor, the average revenue tonnage per freighter departure is 28 tonnes. Approximately 40% of Mumbai cargo moves on freighters. We do not have the information for the share of Bangalore cargo moving on freighters but the ratio of freighter take-off tonnage to total passenger and freighter tonnage is actually higher for Bangalore than for Mumbai. Conservatively, we applied the 40% ratio observed at Mumbai. To calculate the freighter movements we multiplied the cargo tons by 40% and divided by the estimated 28 ton average payload. For purpose of comparison, the 2034 cargo volumes represent about 30% of Mumbai airport's current cargo tonnage and 20% of the cargo freighter movements.

Compared to the national market, the Goa projections represent significantly accelerated growth. By 2014, Goa is expected to have a 0.7% share of the Indian cargo volume versus only 0.4% today. By 2034 the share is projected to rise to 0.9%. This is a proportionately large share given the relative size and GDP of the state, which represents only 0.1% of India's population.

India and Goa Comparitive Cargo Forecast									
	Tonnes (000's)								
Year	Goa			Rest of India			All India		
	Domestic	Int'l	Total	Domestic	Int'l	Total	Domestic	Int'l	Total
2005	3.3	1.6	5	469.4	850.2	1,319.6	472.7	851.8	1,324.5
2014	6.5	9.8	16.3	877.2	1,609.7	2,487.0	883.7	1,619.5	2,503.2
2024	22.0	19.3	41.3	1,633.6	3,124.8	4,758.4	1,655.5	3,144.1	4,799.6
2034	40.1	35.7	75.8	2,924.8	5,866.2	8,790.9	2,964.8	5,901.9	8,866.7

5.5.3. Aircraft Movements

An analysis of load factors and average passengers per movement by market, a review of the fleet plans of the known carriers, and an assumption with respect to the capacity of the operating aircraft are applied to translate the projected passenger volumes into an estimate of aircraft movements. There are a number of factors that suggest that passenger per flight and aircraft capacity will be increasing.

Current international scheduled flights operate at high load factors only during the peak season. The estimated international load factor of 80% in 2004 is not excessive given that over 80% of the seats are on charter operations. The estimated 2004 domestic load factor of 65% is below the break even requirements of the low cost carriers and with the introduction of discount fares will be less than satisfactory to the traditional carriers.

Indian national carriers are in the midst of significant fleet renewal and expansion. The fleet plans of the start up carriers are built around aircraft in the 150-seat range. The majority of the replacement and new aircraft reflect an increase in capacity from the current average of 116 seats per domestic flight and 168 seats per scheduled international flight.

We also note that carriers respond to increasing traffic through both increased frequency and introduction of larger aircraft. As frequencies reach target levels, carriers will add capacity through larger aircraft as opposed to additional flights. While airport modernization is a significant current initiative, the anticipated rapid expansion of air travel services in India implies congestion problems will be a constant operational concern. This will tend to encourage capacity versus frequency increases.

The following table details the projected movements for both passenger and cargo aircraft for each route group over the period 2005 to 2014.

Annual Aircraft Movements

Year	Passenger				Cargo				Grand Total
	Domestic	International		Total	Domestic	International		Total	
		Regional	Long Haul			Regional	Long Haul		
2005	11,405	643	1923	13,971	0	0	0	0	13,971
2006	12,445	715	1960	15,120	0	0	0	0	15,120
2007	13,554	791	1995	16,340	0	0	0	0	16,340
2008	14,516	871	2029	17,416	0	0	0	0	17,416
2009	15,546	960	2067	18,573	0	0	0	0	18,573
2010	16,671	1,064	2125	19,860	0	0	0	0	19,860
2011	17,899	1,186	2200	21,285	0	0	0	0	21,285
2012	19,240	1,332	2300	22,872	17	11	3	31	22,903
2013	20,602	1,480	2381	24,463	26	18	4	48	24,511
2014	22,019	1,651	2477	26,147	36	25	6	67	26,214
2024	33,545	2,918	3090	39,553	225	154	39	418	39,971
2034	55,305	4,788	3907	64,000	583	400	100	1083	65,083

Overall passenger aircraft movements are forecast to grow at an average of 7.2%, 5.6%, and 5.4% for 2014, 2024, and 2034 respectively. This is marginally lower than the 8.2%, 6.5%, and 6.0% forecast for the total passenger traffic. While the rate of growth for freighter movements is considerably more dramatic, the small relative share of cargo movements does not material affect the combined growth rate. The average number of passengers per flight is expected to rise from 87 and 150 to 102 and 196 for domestic and international flights respectively during the 2005 to 2034 period.

The following table presents a regional break down of the forecast passenger aircraft movements. It demonstrates the increased predominance of the regional international markets especially the Middle East. It also demonstrates the static distribution between domestic and international travel over the forecast horizon.

Aircraft Movements by Region

	2014			2024			2034		
	Passenger	Cargo	Total	Passenger	Cargo	Total	Passenger	Cargo	Total
Domestic	22,019	36	22,055	33,545	225	33,770	55,305	583	55,888
International - Regional	1,875	25	1,900	2,919	154	3,073	4,788	400	5,188
Africa	56			122			183		
Middle East	1,148			2,016			3,201		
South Asia	232			334			499		
South East Asia	439			447			925		
International - Long Haul	2,253	6	2,259	3,089	39	3,128	3,907	100	4,007
Europe	2,253			2,988			3,689		
North East Asia	-			66			147		
South Pacific	-			35			71		
International Total	4,128	31	4,159	6,008	193	6,201	8,695	500	9,195
Grand Total	26,147	67	26,214	39,553	418	39,971	64,000	1,083	65,083

The aircraft movements have been further split into ICAO Maximum Take Off Weight categories. Evaluation of the relative movements by category and world region for traffic at Mumbai, Hyderbad and Bangalore, as well as the existing Dabolim operations were used to develop the percentage distributions. These were then applied to the forecast volumes presented above.

Aircraft Movements by MTOW Category

Region/ MTOW Category	2005	2014			2024			2034		
	Passenger	Passenger	Cargo	Total	Passenger	Cargo	Total	Passenger	Cargo	Total
Domestic	11,405	22,019	36	22,055	33,545	225	33,770	55,305	583	55,888
0 (less than 10 tonnes)	0	0	0	0	0	0	0	0	0	0
1 (10 to 20 tonnes)	3431	2,594	0	2,594	3,952	0	3,952	6,515	0	6,515
2 (20 to 50 tonnes)	634	1,094	0	1,094	1,666	0	1,666	2,747	0	2,747
3 (50 to 100 tonnes)	6682	16,634	33	16,667	25,341	207	25,548	41,779	535	42,314
4 (100 to 200 tonnes)	659	1,225	3	1,228	1,866	18	1,884	3,076	48	3,124
5 (200 to 400 tonnes)	0	472	0	472	720	0	720	1,187	0	1,187
International Regional	643	1,875	25	1,900	2,919	154	3,073	4,788	400	5,188
0 (less than 10 tonnes)	0	0	0	0	0	0	0	0	0	0
1 (10 to 20 tonnes)	0	0	0	0	0	0	0	0	0	0
2 (20 to 50 tonnes)	0	103	0	103	150	0	150	217	0	217
3 (50 to 100 tonnes)	337	586	3	589	905	21	926	1,463	55	1,518
4 (100 to 200 tonnes)	306	875	5	880	1,329	29	1,358	2,090	75	2,165
5 (200 to 400 tonnes)	0	311	17	328	536	104	640	1,018	270	1,288
International Long Haul	1,923	2,253	6	2,259	3,089	39	3,128	3,907	100	4,007
0 (less than 10 tonnes)	0	0	0	0	0	0	0	0	0	0
1 (10 to 20 tonnes)	0	0	0	0	0	0	0	0	0	0
2 (20 to 50 tonnes)	0	0	0	0	0	0	0	0	0	0
3 (50 to 100 tonnes)	0	613	1	614	840	0	840	1,063	1	1,064
4 (100 to 200 tonnes)	1291	666	0	666	913	0	913	1,155	-1	1,154
5 (200 to 400 tonnes)	632	974	6	980	1,334	39	1,373	1,689	100	1,789
International Total	2,566	4,128	31	4,159	6,008	193	6,201	8,695	500	9,195
0 (less than 10 tonnes)	0	0	0	0	0	0	0	0	0	0
1 (10 to 20 tonnes)	0	0	0	0	0	0	0	0	0	0
2 (20 to 50 tonnes)	0	103	0	103	150	0	150	217	0	217
3 (50 to 100 tonnes)	337	1,199	4	1,203	1,745	21	1,766	2,526	56	2,582
4 (100 to 200 tonnes)	1597	1,541	5	1,546	2,242	29	2,271	3,245	74	3,319
5 (200 to 400 tonnes)	632	1,285	23	1,308	1,870	143	2,013	2,707	370	3,077
Grand Total	13,971	26,147	67	26,214	39,553	418	39,971	64,000	1,083	65,083
0 (less than 10 tonnes)	0	0	0	0	0	0	0	0	0	0
1 (10 to 20 tonnes)	3431	2,594	0	2,594	3,952	0	3,952	6,515	0	6,515
2 (20 to 50 tonnes)	634	1,197	0	1,197	1,816	0	1,816	2,964	0	2,964
3 (50 to 100 tonnes)	7019	17,833	37	17,870	27,086	228	27,314	44,305	591	44,896
4 (100 to 200 tonnes)	2256	2,766	8	2,774	4,108	47	4,155	6,321	122	6,443
5 (200 to 400 tonnes)	632	1,757	23	1,780	2,590	143	2,733	3,894	370	4,264

Finally, a projection of landed tonnage is calculated from the average tonnage per aircraft by market segment with a gradual escalation over the planning period. Once again, observations of the Mumbai, Bangalore, and Hyderabad operations are used to assist in developing the average weight by category. The Dabolim operation is used primarily for estimating the aircraft characteristics associated with the charter operation. Landed tonnage for passenger and cargo operations, by route type are presented below.

Landed Aircraft Tonnage By MTOW Category and Region (Thousands of Tonnes)

Region/	2005	2014			2024			2034		
MTOW Category	Passenger	Passenger	Cargo	Total	Passenger	Cargo	Total	Passenger	Cargo	Total
Domestic	639.9	1,605.2	2.4	1,607.6	2,445.8	14.9	2,460.7	4,032.2	38.8	4,071.0
0 (less than 10 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 (10 to 20 tonnes)	57.9	43.8	0.0	43.8	66.7	0.0	66.7	110.0	0.0	110.0
2 (20 to 50 tonnes)	14.6	25.2	0.0	25.2	38.3	0.0	38.3	63.2	0.0	63.2
3 (50 to 100 tonnes)	470.1	1,170.4	1.9	1,172.3	1,783.0	12.0	1,795.0	2,939.6	31.0	2,970.6
4 (100 to 200 tonnes)	97.2	180.7	0.5	181.2	275.3	2.9	278.2	453.7	7.7	461.5
5 (200 to 400 tonnes)	0.0	185.2	0.0	185.2	282.5	0.0	282.5	465.7	0.0	465.7
International Regional	68.8	294.7	7.7	302.4	473.5	47.2	520.6	815.6	122.5	938.1
0 (less than 10 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 (10 to 20 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 (20 to 50 tonnes)	0.0	2.4	0.0	2.4	3.5	0.0	3.5	5.0	0.0	5.0
3 (50 to 100 tonnes)	23.7	41.2	0.2	41.4	63.7	1.2	64.9	102.9	3.2	106.1
4 (100 to 200 tonnes)	45.1	129.1	0.8	129.9	196.0	4.7	200.7	308.3	12.1	320.4
5 (200 to 400 tonnes)	0.0	122.0	6.7	128.8	210.3	41.3	251.6	399.4	107.2	506.6
International Long Haul	438.4	523.5	2.4	525.9	717.1	15.5	732.6	907.8	39.6	947.4
0 (less than 10 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 (10 to 20 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 (20 to 50 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 (50 to 100 tonnes)	0.0	43.1	0.1	43.2	59.1	0.0	59.1	74.8	0.1	74.9
4 (100 to 200 tonnes)	190.4	98.2	0.0	98.2	134.7	0.0	134.7	170.4	-0.2	170.2
5 (200 to 400 tonnes)	247.9	382.1	2.4	384.5	523.4	15.5	538.8	662.6	39.7	702.3
International Total	507.2	818.2	10.2	828.3	1,190.6	62.7	1,253.2	1,723.4	162.1	1,885.5
0 (less than 10 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 (10 to 20 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 (20 to 50 tonnes)	0.0	2.4	0.0	2.4	3.5	0.0	3.5	5.0	0.0	5.0
3 (50 to 100 tonnes)	23.7	84.4	0.2	84.6	122.8	1.2	124.0	177.7	3.2	181.0
4 (100 to 200 tonnes)	235.6	227.3	0.8	228.1	330.7	4.7	335.4	478.7	11.9	490.6
5 (200 to 400 tonnes)	247.9	504.1	9.1	513.3	733.6	56.8	790.4	1,062.0	146.9	1,208.9
Grand Total	1,147.1	2,423.4	12.6	2,436.0	3,636.4	77.6	3,713.9	5,755.6	200.8	5,956.4
0 (less than 10 tonnes)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 (10 to 20 tonnes)	57.9	43.8	0.0	43.8	66.7	0.0	66.7	110.0	0.0	110.0
2 (20 to 50 tonnes)	14.6	27.5	0.0	27.5	41.8	0.0	41.8	68.2	0.0	68.2
3 (50 to 100 tonnes)	493.9	1,254.7	2.1	1,256.9	1,905.8	13.2	1,919.0	3,117.3	34.3	3,151.6
4 (100 to 200 tonnes)	332.8	408.0	1.3	409.3	606.0	7.6	613.5	932.4	19.6	952.1
5 (200 to 400 tonnes)	247.9	689.3	9.1	698.4	1,016.1	56.8	1,072.9	1,527.7	146.9	1,674.6

Overall landed tonnage is forecast to increase from 1.1 million to 6.0 million metric tonnes during the period 2005 to 2034. The most significant increases are in the category 3 and category 5 aircraft which represent 78% of the landed tonnage in 2014 verus 63% in 2005.

5.6. Sensitivity Analysis

In an attempt to measure the risk associated with the forecast, the following three sensitivity tests were conducted:

- Measure the impact of slower or faster economic growth on demand;
- Measure the impact of higher or lower yields on demand; and
- Measure the impact on demand if tourist infra-structure and capacity does expand as projected.

The impact of changes in economic assumptions has been evaluated for both passenger and cargo traffic. The impact of varied yield assumptions or a limitation in tourist capacity have only been examined with respect to the passenger forecast. In all three cases, the sensitivity analysis has been conducted for years 2014 and 2024.

5.6.1. The Economy

In the pessimistic scenario, the Indian economy will grow at 5.5% per annum from 2005 to 2014 as opposed to the 6.5% assumed in the plan. The economy of the state of Goa would have a similar 1% slower growth rate of 7.1%. We have earlier pointed out the correlation between GDP expansion and growth in air transportation. In this case, however, we are hesitant to forecast a significant slow down in the traffic growth given the other changes occurring in the aviation section. A 5.5% growth is still a rapid rate of expansion and unlikely to deter the plans of the start-up carriers nor the fleet renewal and additions planned by the existing carriers. A lower growth might help to keep yields in check and in turn support the market expansion. We have therefore applied only a 0.5% reduction to the passenger growth rate.

In the optimistic scenario the Indian and Goa economies both grow at 1% faster than projected or 7.5% and 9.1% respectively for the period 2005 to 2014. While somewhat paradoxical given the comments with respect to a potential slowing of the economy, we believe that a 1% increase in the economic growth rate will have a comparable affect on the rate of passenger growth. An increase will likely accelerate the changes that are already in place and add impetus to the expansions currently being experienced.

With respect to cargo traffic, a slowing of the economy may have more of an impact to the extent it delays the build up of the business infra-structure necessary to support the development of the largely new cargo service. The cargo growth rate is, accordingly expected to drop a parallel 1%. Similarly, while the cargo traffic is forecast to grow faster than passenger volumes, a 1% increase in the rate of GDP expansion is not anticipated to result in more than a 1% increase in the cargo growth rates.

Sensitivity Analysis (Econcomic Growth Rate)

	Pessimistic (-1%)		Base Line		Optimistic (+1%)	
	Traffic	Growth	Traffic	Growth	Traffic	Growth
Passengers						
2005	1,377,128		1,377,128		1,377,128	
2014	2,689,232	7.7%	2,803,683	8.2%	3,045,646	9.2%
2024	4,184,253	6.0%	4,553,765	6.5%	5,438,576	7.5%
Cargo (Tonnes)						
2005	4,914		4,929		4,944	
2014	19,982	16.9%	21,095	17.5%	21,778	17.9%
2024	35,565	11.0%	41,258	11.8%	46,783	12.6%

The following table presents the detail results of the pessimistic and optimistic forecasts versus the base line forecast. Under the pessimistic forecast there is a 370 thousand passenger reduction and a 5.7 thousand tonne freight reduction by 2024. The optimistic forecast results in an increase of 885 thousand passengers and 5.5 thousand tonnes of freight in 2024. The net cargo growth is less affected by the change because the growth from 2005 to 2010 has already been constraint to reflect the facility inadequacies.

5.6.2. Passenger Yield Assumption

The pessimistic scenario would suggest a return to the average 4% annual yield increases that had been traditional practise in the India market. Should the low cost carrier strategy prove an unworkable model in the Indian context or should development plans at the major airports be delayed, the airline sector will become quite constraint putting a significant upward pressure on the cost of airfare and 4% annual increases would not be unreasonable. Under the optimistic scenario, the low cost carrier model becomes entrenched and yields begin to fall in line with global trends. We have applied a reduction of 4% in growth under the pessimistic scenario and plus 2% under the optimistic scenario. This is consistent with the assumption that the industry is operating at the point of neutral price elasticity.

The pessimistic scenario results in a significant reduction in passenger traffic of 1 million passengers by 2024. The overall growth rate falls from 6.5% to 5.2%, much closer to the historical average. In the optimistic scenario, passenger volumes increase 520 thousand by 2024 with an average rate of growth of 7.1%.

Sensitivity Analysis (Yield Assumptions)

	Pessimistic (-4%)		Base Line		Optimistic (+2%)	
	Traffic	Growth	Traffic	Growth	Traffic	Growth
Passengers						
2005	1,377,128		1,377,128		1,377,128	
2014	2,220,649	5.5%	2,803,683	8.2%	3,114,764	9.5%
2024	3,580,555	5.2%	4,553,765	6.5%	5,074,413	7.1%

5.6.3. Tourist Capacity

The capacity of the state to maintain the tourist growth associated with passenger projections is an area of potential risk. Under the pessimistic scenario the rate of hotel development slows considerably as the beach accommodation reaches the 46,000 bed constraint and tourist levels reach the 4.1 million upper limit estimated by the World Tourist Organization. Under the optimistic scenario, the efforts by the state to shift tourist demand away from the beach areas to other attractions results in a 10% increase in tourist traffic. Because of the long-range impact of the tourist capacity limits we have, for information purposes, extended this scenario's forecasts to the year 2034.

Sensitivity Analysis (Tourist Accommodation)

	Pessimistic		Base Line		Optimistic	
	Traffic	Growth	Traffic	Growth	Traffic	Growth
Passengers						
2005	1,377,128		1,377,128		1,377,128	
2014	2,771,058	8.1%	2,803,683	8.2%	3,000,006	9.0%
2024	3,897,053	5.6%	4,553,765	6.5%	4,874,306	6.9%
2034	5,077,417	4.6%	7,298,034	5.9%	7,814,830	6.2%

The effect of tourist capacity constraints has little impact on the 2014 forecast but over the thirty-year period results in a 1.3% slower rate of growth and a reduction of 2.3 million passengers from the final forecast. The optimistic scenario generates an additional 197 thousand passengers in 2014, 321 thousand passengers in 2024 and 526 thousand passengers in 2034.

5.7. Busy Day Forecast

IATA has a very specific definition of the "busy" day that needs to be evaluated for airport capacity requirement. A typical "busy" day is the second busiest day in an average week during the peak month. An average weekly pattern of passenger traffic is calculated for that month. Peaks associated with special events such as religious festivals, trade fairs and conventions, and sport events are excluded.

IATA has prepared busy day forecasts for domestic, international and combined operations for each of 2014, 2024, and 2034. It should be noted that the busy day forecast for 2034 becomes extremely subjective and should be used to provide only the most general of guides. Not surprisingly the international, domestic, and combined busy days are not the same. For the International markets, a Sunday in January was chosen to represent the busy day. For domestic markets, a Monday in December provides the busy day. For the combined operations, however, a Thursday in January services as the base for the busy day forecast. It is therefore not possible to add the international and domestic busy days to determine the combined busy day. The combined busy day forecast includes an estimate of cargo aircraft movements.

The busy day forecast has been prepared by an extrapolation of the monthly, day of week, and time of day demand patterns observed at Goa and the surrounding airports. The October 2004 and March 2005 OAG schedules have been used to analyse the daily traffic pattern, by weight and wingspan category for these airports. Goa is undoubtedly the most peaked of the regional operations but this is assumed to flatten out considerably over time. Part of the variability in the current operations is a result of an artificial constraint associated with the morning commercial flight embargo imposed by the military operators of Dabolim airport. The predominance of charter operations in the international schedule results in peak movements around the weekend days. The seasonal weather patterns tend to make Goa a less attractive destination during the monsoon period. The new Mopa airport will not suffer from the same time of day restrictions. There will be a steady shift from a reliance on international charters to more scheduled international services with a more distributed operating schedule. We also believe that the tourist travel season will grow to be a more year round market as improved access, increased awareness and expanded accommodation stimulate traffic in the current shoulder and valley periods.

We have prepared the following three set of graphs. There is one set for the international operation, one for the domestic, and one for the total airport. Within each set there are two graphs showing the daily profile of arriving and departing passengers and two graphs showing the pattern of arriving and departing flights. The graphs depict the forecast demand profile for each of 2014, 2024, and 2034.

The combined international, domestic, and cargo operation has a demand profile similar to the domestic operation which is not surprising given the high proportion of domestic aircraft movements. The peak level operation of the combined busy day is unchanged from the domestic busy day. This may seem surprising but it is a result of the different busy days identified for the domestic and international operations. Fortunately for Mopa, the domestic and international peak day and peak month are different. We are not quite so fortunate with the peak hour. The combined operation profile illustrates the impact of the overlapping morning peak operation on both the arrivals and departures.

The following table summarizes the busy day and busy hour traffic and aircraft movements.

Busy Day and Busy Hour Summary						
	Passengers			Movements		
	2014	2024	2034	2014	2024	2034
International						
Arrivals						
Busy Day	1,765	2,586	3,571	9	14	19
Busy Hour	220	261	308	1	2	2
Departures						
Busy Day	1,765	2,601	3,544	9	14	18
Busy Hour	200	247	336	2	2	3
Domestic						
Arrivals						
Busy Day	3334	5546	9129	31	47	78
Busy Hour	395	482	770	2	6	7
Departures						
Busy Day	3338	5547	9126	32	48	78
Busy Hour	332	428	691	3	5	7
Total						
Arrivals						
Busy Day	4887	7509	11763	39	59	95
Busy Hour	391	529	818	4	7	8
Departures						
Busy Day	4868	7508	11763	41	60	94
Busy Hour	416	497	784	4	6	8

International busy day and busy hour traffic volumes are forecast to grow at 3.8% and 3.0% over the period. Domestic busy day and busy hour volumes are forecast to grow at 5.2% and 5.1%. These are considerably slower rates than the overall international and domestic growth forecasts of 5.2% and 6.0% and are reflective of the anticipated flattening of the peaks. This is most evident in the international forecast with the significant shift of demand towards more regional markets and presumably a more daily operation. The busy hour growth rate is slower than the busy day growth rate reflecting the extended hours of operation that will be available with the Mopa facility.

To determine necessary runway capacity, it should be considered that the peak hour is the sum of the busy hour (as expressed in the table hereabove) and the following or preceding hour, depending on traffic. It also has to be noticed that some movements have been added in order to take into account business, general aviation, helicopters movements. This assumptions lead to the following :

- 2014 : 15 mvts/hour Arrival + Departures
- 2034: 27 mvts/hour Arrival + Departures.

5.8. Conclusion

IATA has provided a conservative estimate of the potential passenger, cargo and aircraft traffic that a new international airport at Mopa in the state of Goa could expect to experience. We have limited our growth projections to those elements that have some empirical or observational validity or were generally accepted by the industry expects to whom we spoke. We are confident the economic and yield assumptions are realistic and the potential for new business and connecting traffic has been appropriately addressed.

We recognize that the distribution between international and domestic traffic seems to favour the domestic traffic more than would have been accepted but point out that the international traffic assumptions still represent a considerably above average rate of growth. In light of the development of international facilities in the more dominant surrounding urban centres we have to assume that Mopa will be facing some stiff competition with respect to attracting international services other than those that are tourist oriented.

Potentially of greater concern is the tourist capacity of the state. While share of tourist traffic falls over the period of the plan it still represents the most dominant share and limitations in this regard put the forecast at some risk.

The busy day forecast was developed through a very detailed evaluation of the traffic patterns in the region and dependents somewhat heavily on an assumption that both domestic and international traffic become more evenly distributed throughout the day, week, and year. It is difficult to estimate how quickly carriers will adapt their operations to take advantage of the increased availability but we believe the airlines' needs for operational efficiency will result in a relatively fast response.

Growth prospects for Goa are extremely positive. As a tourist destination, Goa is very competitive on the world stage and economically it will develop ahead of the rest of the country. Dabolim airport, in it's current form, will not be able to handle the demand that will occur in the coming years and will become a significant impediment if the constraints are not appropriately addressed.

6. Airport Requirements

6.1. Foreword

Airport requirements that are presented in the following chapters have been computed for three different stages. The terms 2014 and 2034 are based on traffic forecasts given in chapter 5.
An Ultimate phase has been introduced, with an objective in terms of passengers handled of 10 millions pax/year. This forecast and associated requirements are used to check whether the Master Planning solution could cope with unexpected growth of traffic or could be developed without major problem after the year 2034.
The Master Plan of this Ultimate Stage is given as a zoning as far as it is difficult to plan precisely axis of development.

6.2. Main Building Requirements

6.2.1. Introduction

Conceptual design for the Passenger Terminal and the Air Traffic Control Tower has been carried out in order to precisely assess the Investment Cost for these two major buildings. This work shall not be taken as a limitation and other concepts could be studied in further stages of studies.

6.2.2. Passenger Terminal Building

6.2.2.1. Program and requirements

References from Dabolim terminal

According to Dabolim airport operators, the total gross area of Dabolim terminal is around 12 000 m². The terminal was saturated during year 2003 (especially in the international part). Saturation was expected also for 2004-2005 in the domestic part.

Traffic in Dabolim for 2003 and 2004 and forecast for 2005 range from 0.9 Mpax to 1.2 Mpax with a majority of domestic traffic (63 to 65%). This could seem very consistent with the usual ratios observed on international airports around the world (8 000 to 10 000 m² per Mpax domestic and 12 000 to 14 000 m² per Mpax international), but:

- With a closer look on peak hours ratios, which are pretty high in Dabolim, this seems to be on the low range,
- Dabolim terminal is composed of two distinctive parts for domestic and international traffic and as such does not benefit from a synergy of capacities,
- Some procedures used in Dabolim should not be taken as references for the sizing of a new large terminal (such as baggage security control),
- Dabolim terminal has no contact stands, only remote stands and as such does not possess boarding bridges and fixed bridges allowing direct access to aircrafts.

It is then inappropriate to set the determination of the area needs for Mopa site terminal on this reference as it is very unlikely that a terminal with a traffic over 2,5 Mpax would function with the same procedures.

Mopa terminal sizing will then be set on the basis of a new calculation taking into account the different areas it is composed of.

Still, statistical datas regarding service times in Dabolim can be used for the calculation.

- International check-in process time: 145 seconds,
- Emigration process time: 64 seconds,
- Security check process time: 15 seconds,
- Immigration process time: 42 seconds.

Mopa terminal sizing

As it is common in India, Mopa terminal will be composed of two distinctive parts handling domestic and international traffic.

The terminal will include fixed bridges and boarding bridges for all contact stands. It will then be conceived on the 1.5 floor model (1 floor curbside and 2 floors airside).

It is important to note that international traffic generates high peak period : the strong seasonality of this traffic and the concentration during the day of the arrivals/departures sequences tends to generate high peak period compared to the annual traffic.

The table below summarizes necessary gross floor areas for 2014 and 2034 horizons.

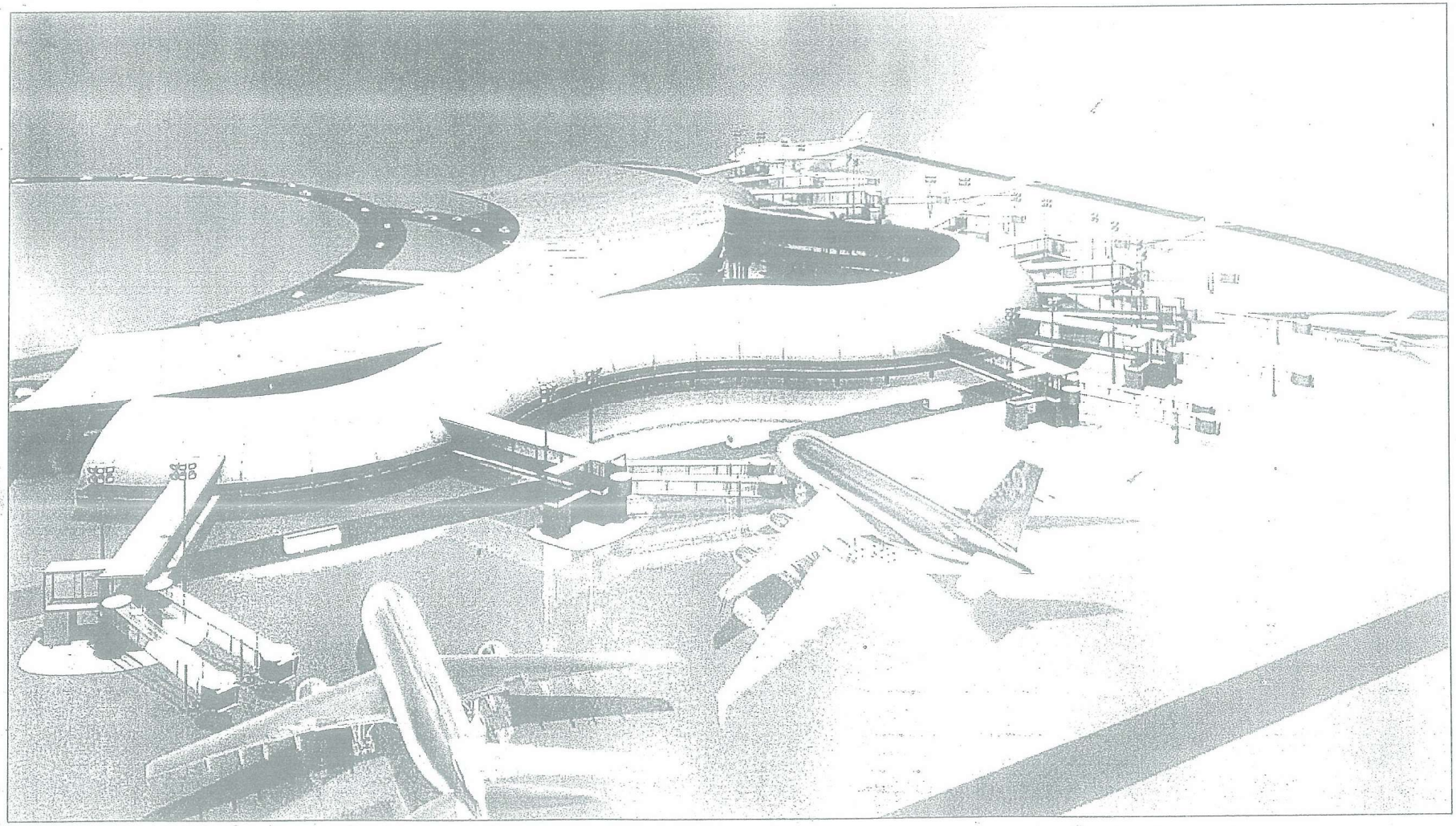
For ultimate development, it is necessary to have 94 100 m² for Terminal (33 900m² for domestic part and 60 200 m² for international part).

		2014	
Year traffic (MPax)		International pax	Domestic pax
A or D		376 603	1 025 239
A+D		753 203	2 050 478
Int & % Dom.		27%	73%
Peak hour		International pax	Domestic pax
A or D		400	550
Departure or arrival peak rate		19%	10%
		International terminal	Domestic terminal
Public Hall			
Departure passengers occupancy time	15 minutes		
Arriving passengers occupancy time	5 minutes		
Minimum depth	6 m		
	Surface	399 m²	548 m²
Information desks in public area			
Positions	2 positions		
Width	1,5 m		
Depth	3 m		
Depth in front of position	2 m		
	Surface	15 m²	15 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		14	15
	Surface	617 m²	662 m²
Emigration			
Width	1,7 m		
Depth	2,4 m		
Depth in front of emigration desks	15 m		
Number of positions		8	
	Surface	237 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		2	3
	Surface	161 m²	277 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
Departure Control System Wide Body area	100 m²		
Departure Control System Narrow Body area	50 m²		
	Surface	3 143 m²	2 629 m²
Bagage sort			
Collector conveyor (2,5 m width room)		74 m²	79 m²
Luggage control area		300 m²	300 m²
Baggage sorting equipment		1 000 m²	1 000 m²
	Surface	1 374 m²	1 379 m²

Commercial area			350 m²	350 m²
Benefit-centres, duty free shops & minor reserves			100 m²	100 m²
Reserves near pier in public area			120 m²	120 m²
Commercial desks in ZP			570 m²	570 m²
	Surface			
Immigration				
Width	1,7 m			
Depth	2,4 m			
Depth in front of immigration desks	20 m			
Number of positions			7	
	Surface		267 m²	0 m²
Baggage claim				
Wide Body units			2	1
Narrow Body units			0	2
Customs			1	
	Surface		1 600 m²	1 800 m²
Services				
Infirmary			20 m²	20 m²
Lavatories in public hall (men and women)			5	7
Lavatories (men and women)			7	8
Lavatories in boarding lounge (men and women)			14	15
Marketing services, advertising			76 m²	103 m²
	Surface		304 m²	353 m²
Employees offices and facilities in public area and security area				
Back offices				
Changing room				
Lavatories & showers				
Reserves				
Offices, assembly rooms				
	Surface		1 130 m²	3 076 m²
Delivery pier (common)				
Trucks positions			4	
Pier width	5 m			
Ramps			2	
	Surface (50%/50%)		223 m²	223 m²
Technical areas				
Ratio	12% of gross area			
	Surface		1 771 m²	2 036 m²
SUP (useful surface programme)			11 810 m²	13 576 m²
Circulation & architecture				
Ratio	25% of SUP			
	Surface		2 952 m²	3 394 m²
	Gross area		14 762 m²	16 970 m²
TOTAL			31 732 m²	

Table 6.1: 1st phase (2014) Terminal Building Program (2 tables)

NEW GOA INTERNATIONAL AIRPORT

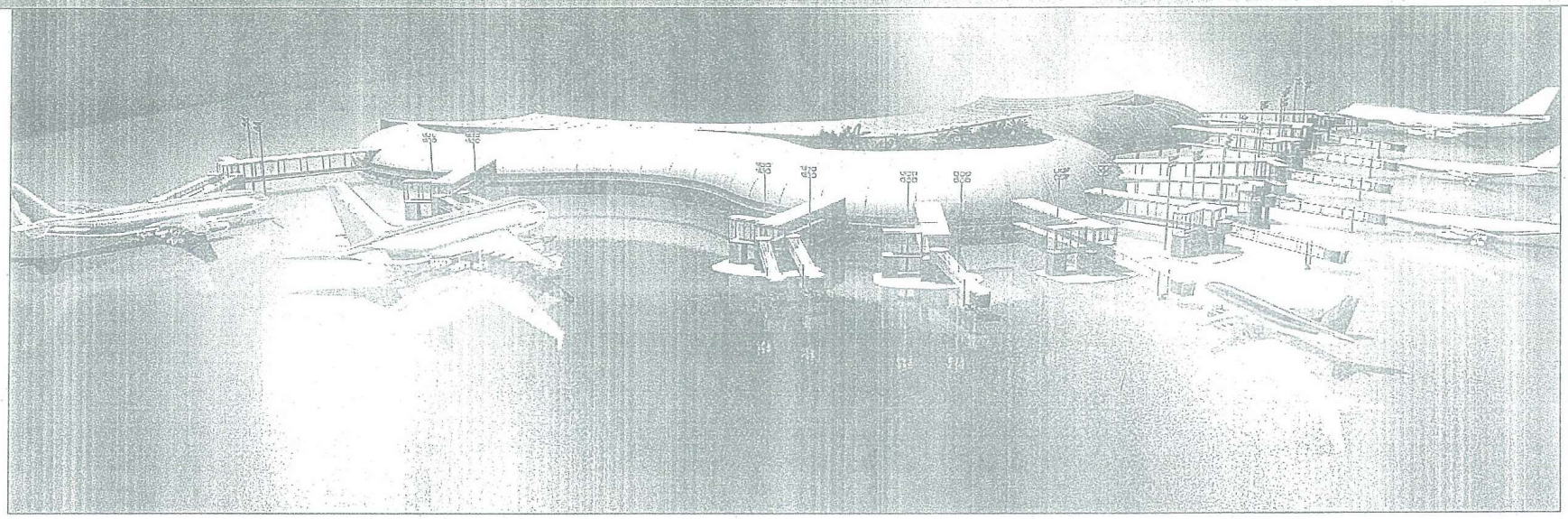


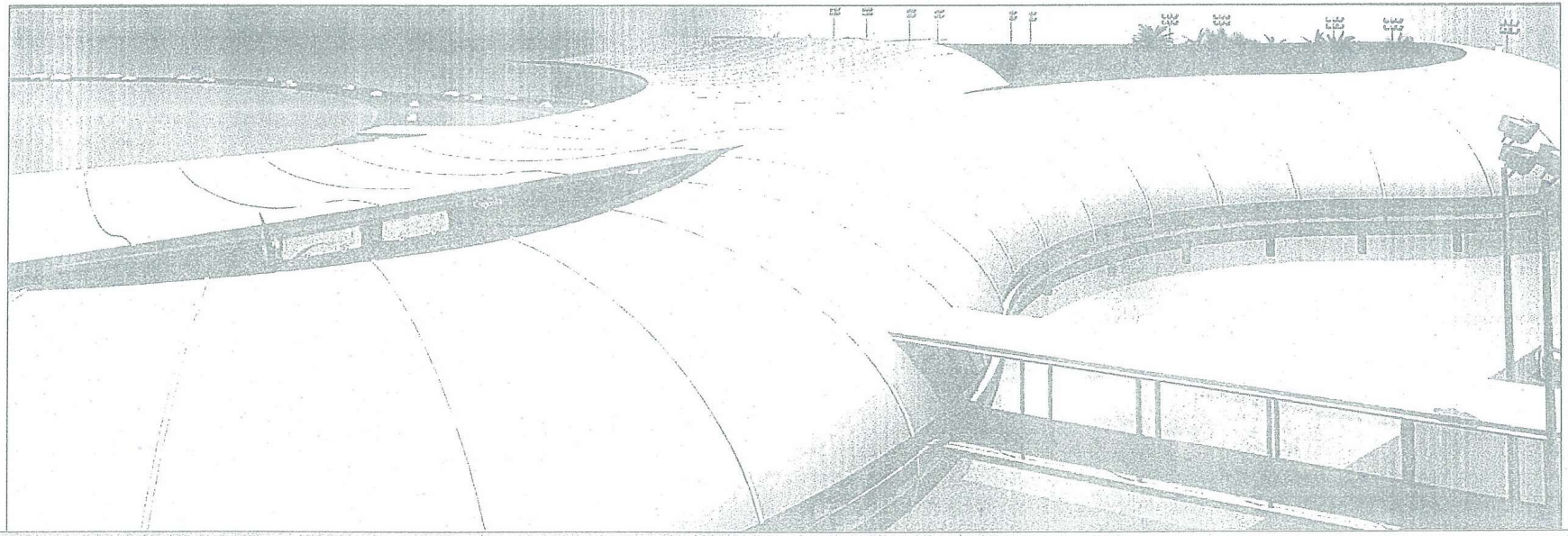
Date: August 2005

FEASIBILITY STUDY - 3D VIEW 2

ADPi

NEW GOA INTERNATIONAL AIRPORT





Date: August 2005

FEASIBILITY STUDY - 3D VIEW 3 & 4

ADPi

6.2.3. Air Traffic Control Tower

6.2.3.1. Location & Height

The main aim of the ATCT is to have a clear view on Runways, Taxiways and Taxilanes, especially near the Thresholds, on Apron, on Short finals (last 5 NM of landings trajectories) and on downwind.
The view shall be 360° capable. The structural beams of the cabin shall be fairly distributed around the cab. The windows shall have a slope of 18° to 20° to avoid reflections.

The Tower shall not impact on flight safety or limit the receiving ability of the airport.

The height of the Tower is mainly based on the height of thresholds that are the parts of manoeuvring area that are the most far from the Tower. It will be located on the installation frontage, centrally positioned in regard with the first runway.
The Ground Level of the Tower area is expected to be between 160 and 165 m. The height is defined based on relative level of thresholds and the state-of –the –art rules of the 1% for visibility assessment.
The Controllers eyes height (when sited) shall be at least 196,6 m. A clearance of around 4 meters shall be taken between eyes of controllers and roof top.

The height of the Tower will be conservatively defined at 40 m. A red infringement lamp will be installed on the top of the Tower.

6.2.3.2. Architectural conceptual design

Our concept is foreseen to become a symbol of the New Goa international airport. Each arriving or departing passenger would recognize this unique and specific building.
The lotus flower has been used as basis for our design
It is an element that is typical in exotic places as well is used since Antiquity.
The ATCT is dynamic and turned to the sky.
The lotus flower opens upward and is suggested through triangular vertical facades ("the leaves").
Between these leaves (white concrete), green ceramic tiles are installed and enlightened with luminous points that will be closer on the upper part of the shaft then on the first floor.
The white concrete parts will be self cleanable due to the implementation of surface treatment anti-mould and anti-graffiti.
The natural daylight will enter the shaft though dedicated openings, located between green ceramic tiles
Even if the shape looks sophisticate and complex, the concrete structure remains simple

The technical block reminds also this concept of lotus flower. It will be designed in accordance with the tower design (White concrete & green ceramic).
It consists in two floors:
The ground floor is divided into two parts by the corridor that accesses to the tower
- First part is dedicated to building technical rooms
- Second part is dedicated to operational rooms and specific ATC equipment rooms.

A core housing vertical circulations (stairs & lift) is centrally located.
The first floor is expected to house administrative functions, conference room…
A protected corridor will allow circulation and will link offices to the core.

6.2.3.3. Functional definition

Tower will be sized for the management of the first runway and will be located accordingly. The peak hour to be considered is the traffic peak for 2034 (27 mvts/hour Arrivals + Departures -).

The ATS complex will consist in :

- The Tower, which will house :
  - The tower cab,
  - The ATC technical compartment,
  - Upper level restroom and break room,
  - Rooms for HVAC and Power Distribution Frame,

- The Technical Block, which will house :
  - The Approach Control Room
  - The Equipment compartment and associated workshops,
  - Theoretical training room and library,
  - Rest areas,
  - Offices
  - Chilled water production
  - Back up Power supply,
  - Power distribution (including UPS and Batteries),
  - Classical building facilities,

The traffic forecasts taken into account are 27 mvt/hour. They will be mainly used to define the number of Control sectors to be implemented and the number of CWP[1] to be built and equipped.

The vertical circulations in the tower will be made through two elevators; one is for personnel and is a high speed elevator, when the second is a cargo elevator, wider and slower. The high speed elevator will deserve the storey located two storeys under the control cab, due to overhead clearance.

6.2.3.4. Controllers Working Positions definition

Positions in Tower Cab

The number of control positions will be adapted to the treatment of the peak hour in a long term view in order to properly size the area of the control cabin. When considering the 2014 runway peak hour (15 mvts/hour A + D), it seems that it is not usefull to have two Ground positions. Then Ground West position won't be equipped in first stage.

The following CWP will be installed in the tower cab :

- One Local
- One Assistant Local
- One Ground East
- One Ground West (built but not equipped)

[1] Controller Working Position

- One Back up position (for Local and Ground)
- One Supervisor
- One Flight Data/Clearance Delivery
- One Panel for AFL, Navaids control and monitoring, rescue plans…

The CWP will be located on a 60 to 80 cm-high podium. A peripheral corridor shall be implemented for maintenance at the backside of CWP (in order to avoid any impact on operations).

The Local position will be located in the best place facing the runway, close taxiways, finals / departures / go-arounds.

Ground position will also have to manage aircraft movements on Apron as well as circulation of vehicles in airside. Some cameras could be implemented on the roof of the Terminal and displayed on a quadrivision screen on Ground position, so as to have a clear view on stands occupancy in shaded area, if any.

Local and Ground position will be split only during peak hours. Ground West position will be equipped once traffic pressure will ask for.

Area needed : 75 sq.m. that means a radius of 4,9 m in the Control Cab.

Positions in Approach Room :

Approach control will be done in a dedicated room, located in the Technical Building.

The CWP to be installed in first phase are :

- One Arrival
- One Assistant Arrival
- One Departure
- One Assistant Departure – May be used as Back Up for Departure
- One Supervisor
- One Back Up for Arrivals
- One Back Up for Local

Arrival position (and its assistant position) will handle aircraft from hand off from ACC[2] up to 5 NM of active threshold.
Departure positions work aircraft after airborne to hand off to ACC.
The back up Local position should be used when access to tower cab is not possible (strong winds, technical failure…).

The Approach room shall provisioned space for:

- One Radar Vectoring

Once the Radar Vectoring position will be implemented according to traffic pressure, Arrival position will be named as Feeder position.(FEEDER positions working aircraft after the hand off from ACC to about 30 NM (on track) to the airport, and RADAR VECTORING positions working aircraft from about 30 NM (on track) to 5 NM to the airport). All these arrival and departure positions play a great part in utilizing the airspace, safely, flexibly and effectively, allowing direct routes, shorter and optimum trajectories.

Area needed for Approach Room: 100 sq.m.

Technical Operator Position

Technical Operator is not an ATC Position. Technical Operator aims to detect all malfunction and/or anomaly from ATC systems and equipments.
It will be located in Approach equipment room located on the ground floor of the technical building.

[2] Air Control Center managing En Route Control Sectors

Item	Area	
Technical Block		
Technical Area		
HVAC Production		
Power Supply		
Storage		
LV Switch		
Guard Shifting		
BMS/Fire detection panel		
Sub Total	520	m²
ATC Technical Area		
ATC Equipment compartment		
Workshop		
Storage		
Sub Total	280	m²
ATC Operational Area		
Approach Control room		
Record & Replay Room		
NOTAM office		
Male Break Room		
Female Break Room		
Lockers, Toilets, Canteen…		
Sub Total	400	m²
ATC Training Area		
Theoretical Training room		
Officesfor instructors		
Library		
Sub Total	105	m²
Administrative Area		
Conference room		
Offices		
Sub Total	325	m²
Total		
Net Area	1630	m²
Circulation (15 %)	245	m²
Architecture (8%)	150	m²
Grand Total	*2024*	*m²*

Tower		
Control Cab	75	m²
ATC Equipment Room	50	m²
Break room	40	m²
Technical rooms	50	m²
Intermediary floors	300	m²
Total		
Net Area	515	m²
Circulation (15 %)	77	m²
Architecture (8%)	47	m²
Grand Total	*640*	*m²*

Overall Total	2664	m²

Table 6.4: Air Traffic Control Tower & Technical Block program.

6.2.3.5. Equipment

The expected peak hour for 2014 and the construction of a single runway result in the fact that there won't be a need for an Advanced Surface Movement Guidance and Control System (A – SMGCS) even for a Surface Movement Radar in first stage, but other domains have to be analysed such as data-link communications, bad weather (monsoon, thunderstorms, micro-burst…) information conditions, supervising and controlling equipment.

Hereunder is given a list of main systems and equipment to be implemented in the Air Traffic Control Tower. These systems shall be of the latest technology available and in compliance with general policy of AAI in terms of Air Traffic Services (especially for Automation).

Weather information : The basic weather information chain has to be reliable, but it is also necessary to have a simple back-up system for the most important weather information (pressure, temperature, wind, visibility, ceiling).

RDPS : Radar Data Processing System, it is the system that treats and correlates the data coming from Airport Surveillance Radars (Primary and Secondary).

FDPS : Flight Data Processing System, it is the system that treats the Flight Plans of all aircraft that flight from/to/over future Goa International Airport and in the Area Of Responsibility of the TMA and CTR.

AFTN Switch : Aeronautical Fixed Telecom Network : the airport will need a Interface between the AFTN and the various peripherals (Briefing offices, NOTAM distribution, GIS, FDP…)

GIS : General Information Display System : the system that treats and distributes Meteorological information (excepted back up MET system that has specific digital displays) and NOTAM, General Information of the Airport, Monitoring of Navaids.

ATIS : Automatic Terminal Information Service : It is the automatic provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive voice broadcast.

RCMS : Remote Control and Monitoring System : it is the global ATC Supervision system (Navaids, Communication). Each component has its proper Supervision system, each computer has its software supervision system. The statuses of all equipment are gathered together in a Central RCMS.

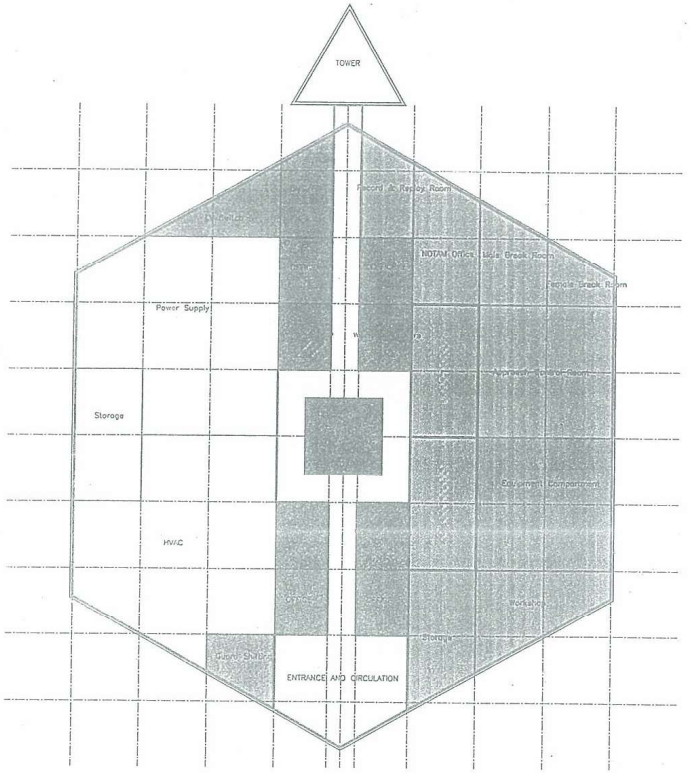
Data and Voice Recorders and Players : the system that records radar displays, communication, correlates the both and is able to play it in the Record & Play Back Room.

GPS Standard Timer : defines and distributes a single reference time to all ATC users. It will be linked with airport Standard timer.

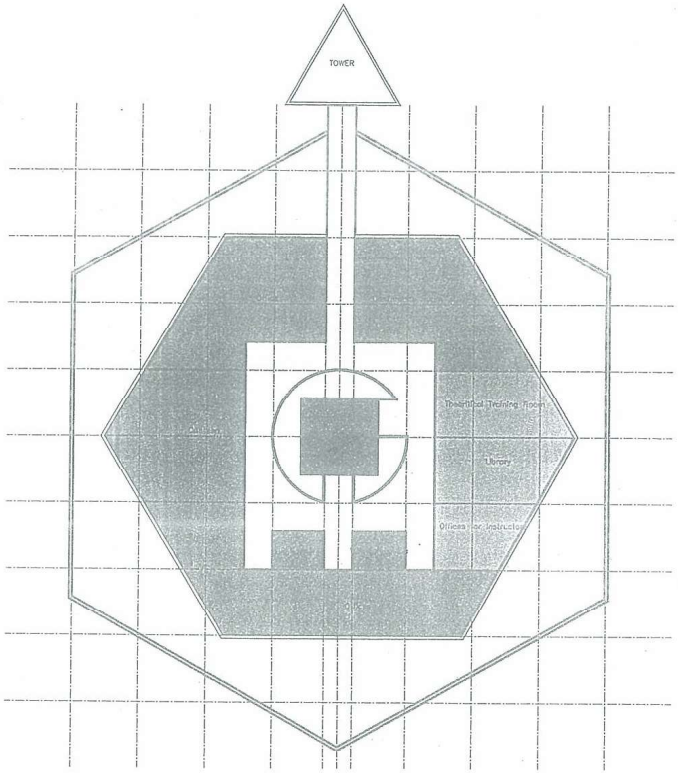
SARAS : Search & Rescue Alert System : the system that treats the various alarms regarding with ATC systems or operational reasons.

VCCS : Voice and Control Communication System : the most important system of ATC Services. It manages Air/Ground Communications (VHF) Ground/Ground Communications, specific ATC telephone lines (ATC PABX) and Intercom. It is linked to Transmitting and Receiving stations, to ACC, to Airport PABX (SSIS, Company offices…)

NEW GOA INTERNATIONAL AIRPORT



GROUND FLOOR: 0.00



LEVEL 1: +4.50

- TECHNICAL AREA
- LV AREA
- ATC EQUIPMENT
- EXTENSION
- OPS AREA
- TRAINING AREA
- ADMINISTRATION AREA
- CIRCULATION
- VERTICAL CIRCULATION
- TOILETS/LOCKERS
- SERVICES

0 2 4 6 8 12 14 16 18 20

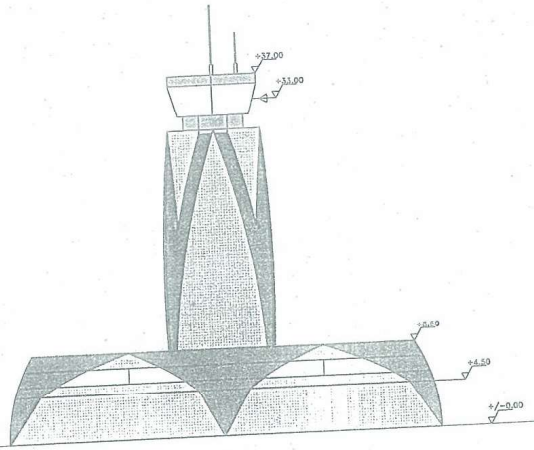
Scale :1/400e

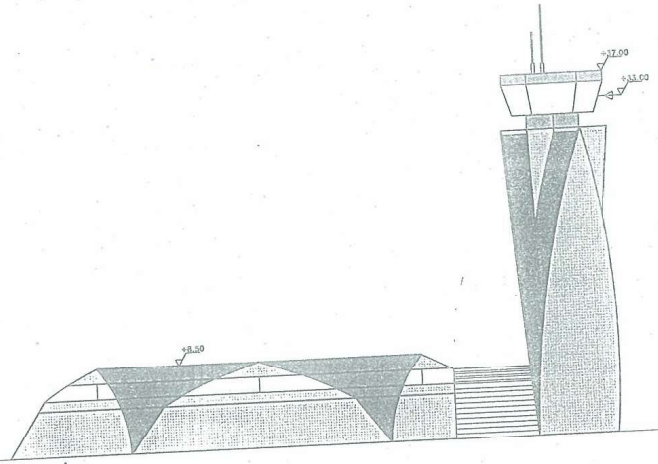
Date: August 2005

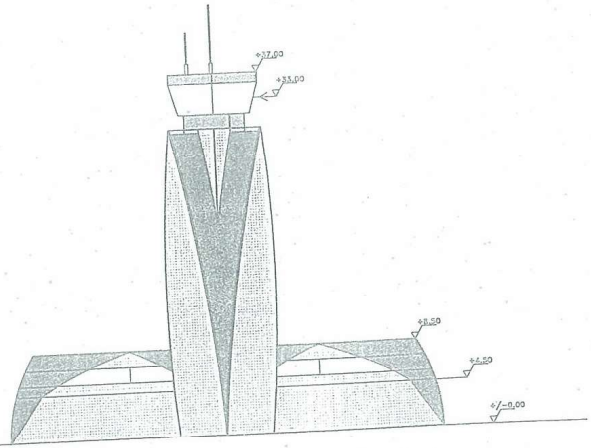
FEASIBILITY STUDY-TECHNICAL BUILDING-ZONING PLANS

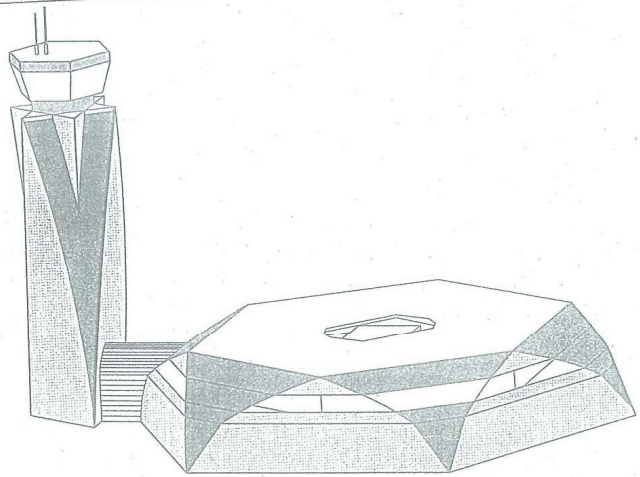
ADP.i

NEW GOA INTERNATIONAL AIRPORT









0 5 10 15 20 25

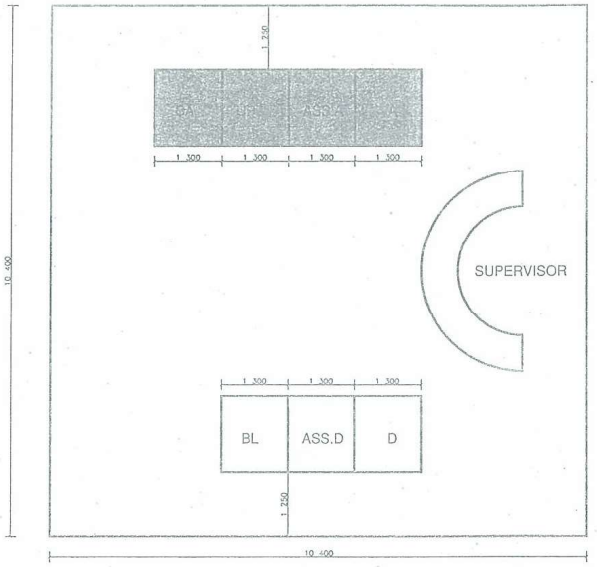
Scale :1/500e

ADP.i

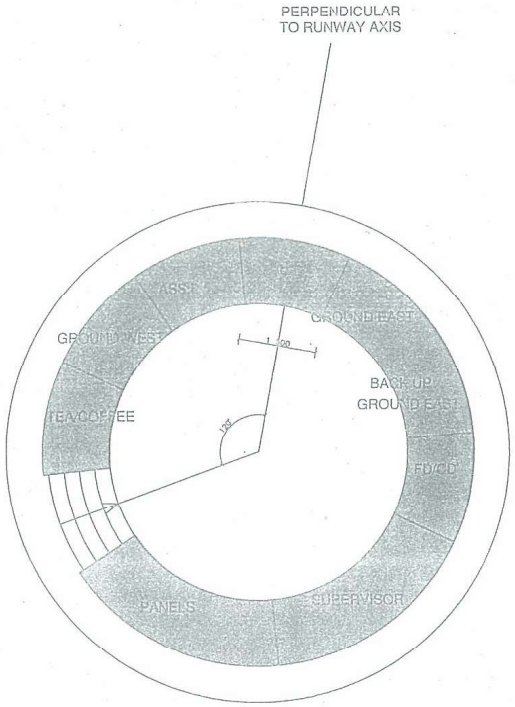
FEASIBILITY STUDY - NORTH / SOUTH / EAST ELEVATIONS AND 3D VIEW

Date: August 2005

NEW GOA INTERNATIONAL AIRPORT



APPROACH CONTROL ROOM



CONTROL CAB

LEGEND-TOWER

- L: LOCAL
- ASS.L: ASSISTANT LOCAL
- FD/CD: FLIGHT DATA / CLEARANCE DELIVERY

APPROACH CONTROL ROOM

- A: ARRIVALS
- ASS.A: ASSISTANT ARRIVALS
- UP: UNEQUIPPED POSITION
- BA: BACK-UP FOR ARRIVALS
- D: DEPARTURE
- ASS.D: ASSISTANT DEPARTURE
- BL: BACK-UP FOR LOCAL

0 2 4 6 4 5

Scale :1/100e

Date: August 2005

ARRANGEMENTS OF CONTROLLERS WORKING POSITIONS: FIRST STAGE

ADPi

6.3. Airport Services & facilities

6.3.1. Security area & control points

The airport will be organized according to the principles of security given in ICAO appendix 17.

Security area will be surrounded by fences (defined according to ICAO regulation with a 2.44 m height including a barbed wire top section inclined toward public area).

A cleared area should be provided on both sides of the fence (total strip of 7 meters) to facilitate the work of patrols and to make trespassing more difficult:

- a 3 meters perimeter road will be provided inside the fence so as to ensure easy access of patrol vehicles and maintenance teams all along the fence,
- a non built 3 meters wide strip will be provided on the outside of the fence with a 1 meter wide ditch to prevent access for vehicles and other equipments enabling fence trespassing.

As it is necessary to allow access for authorized vehicles and persons in the security area, vehicles security control point is necessary in the airport. One will be located near technical facilities and cargo area (so as to allow control and apron access for oversized cargo) and the second will be located near catering facilities at the entrance of the airport.

These access points will provide :

- one area for vehicles access and control,
- three 5 meters covered access lanes with remote controlled barriers,
- one 3 meters exit lane (usable by safety vehicles for access in case of emergency),
- 1 building (bystanders and drivers security check, search point, sanitary & locker room for security team…).

The global need is for an area of 30 m width x 80 m depth = 2 500 m² (2014 and 2034).

For 1st phase of development as well as for ultimate development, 2 access points are necessary (5 000m²).

Other bystanders' security check points will be provided in the terminal and other boundary facilities.

6.3.2. Taxiways

Taxiways should be designed according to the F code of ICAO's annex 14. The width and the aeronautical clearance corresponding to this code are given below :

- width of taxiway (code F reference) : 25 m,
- aeronautical clearance (code F reference) : 57.50 m from the axis of the taxi way (on each side) without obstacles,
- space between the axis of a runway and a taxiway (code F reference) : 190 m,
- space between the axis of two parallel taxiways (code F reference) : 97.50 m.

6.3.3. Apron and taxilanes

6.3.3.1. Taxilane

Taxilanes will be defined according to code E reference :

- width of taxilanes (code F reference) : 25 m,
- aeronautical clearance (code F reference) : 50.50 m from the axis of the taxi way (on each side) without obstacles.

They will be implanted so as to allow a flexible and efficient operation of the apron.

6.3.3.2. Passenger aircrafts commercial stands

There are several methods to calculate the number of stands necessary. The requirements can be evaluated using :

- the number of passengers treated per stand,
- the number of flight movements per year,
- the number of flight movements during peak hour.

As international traffic generates high peak period (strong seasonality and gathering of movements during the day), it is appropriate to calculate the needs considering peak hours movements and Horonjeff method for different steps, then calculate a ratio of passengers per stand.

For domestic traffic which is higher and spread along the day, we will use ratios of passengers per stand.

We use two categories of aircrafts in the calculation for the inception report:

- Narrow bodies (B&C codes according to ICAO classification) – mostly domestic traffic,
- Wide bodies (D&E codes according to ICAO classification) – mostly international traffic.

The master plan will then be designed with apron stands for these two categories.

Passengers per stand per year

The ratio of passengers/stand/year will grow in the future as peak phenomena will decrease. The traffic forecast also indicates a growth of the number of passengers per aircraft which tends to lead to better outputs. For the traffic we are expecting in the future (1.9 to 5.4 MPax domestic and over), we use a ratio of 300 000 pax/stand/year in 2014 and we adjust it with the increase of passengers/aircraft for 2034.

References from Dabolim terminal : turnaround time

According to Dabolim airport operators, the turnaround time for aircrafts is:

- between 30 minutes and 40 minutes for narrow bodies,
- between 90 minutes and 120 minutes for wide bodies (this latter time being considered as a maximum due to excessive time for cleaning or refueling).

We will then take into account a turnaround time of 45 minutes for narrow bodies and 90 minutes for wide bodies in Mopa apron calculations.

The Horonjeff formula is usually used for this kind of peak evaluation. It can be written as:

$$S=\frac{NT}{U}$$

with:
S, the number of active stands
N, the number of flight movements for departure or arrival during peak hour
T, time of stand occupation (in hours)
U, ratio of occupancy of stands

The ratio of occupancy is usually taken as 0.85 for narrow bodies and 0.80 for wide bodies.

The table below shows results for apron stands requirements calculations according to first estimate.

	2014		2034		Ultimate	
	Domestic	International	Domestic	International	Domestic	International
Year traffic						
Passengers	2 050 478	753 205	5 631 445	1 666 590	7 716 386	2 283 615
All aircrafts movements	22 019	4 128	55 305	8 695	73 431	11 715
Passengers/aircraft	93	182	102	192	105	195
Peak day						
Narrow bodies (B, C)	59	5	147	12	195	16
Wide bodies (D, E)	4	17	9	25	12	34
Pax/stand/year	300 000	200 000	328 034	210 095	338 531	213 667
Number of NB stands	6	1	16	3	23	4
Number of WB stands	1	3	1	6	1	8
Total number of stands						
Number of NB stands	7		19		27	
Number of WB stands	4		7		9	

During peak hour period, 70% of the aircrafts stands will be contact stands.

Remote stands will be compatible with autonomous manoeuvring for regional aircrafts.

6.3.3.3. Cargo aircrafts commercial stands

Considering the low traffic levels expected, it does not seem necessary to have a specific cargo apron for freighters for 2014 and 2034 (only one stand for ultimate development). The cargo should be belly cargo and even in the unlikely case of a freighter coming into Goa, a passenger stand or a reserve stand could be exceptionally used.

6.3.3.4. Reserve stands

It is important to note that the previous evaluations give an indication of the number of active stands needed. This number reflects the need for stands to handle the traffic. Depending on the size of the airport, more aircraft stands may be necessary for reserve stands (long time parking, night stays and hazards). This number can be estimated to 20 % of the commercial requirement.

The need is then for 2 reserve stands in 2014 and 5 reserve stands in 2034 (7 for ultimate development).

6.3.3.5. Others

See paragraphs dedicated to general aviation, helicopters area and business aviation.

6.3.4. Passenger Area

6.3.4.1. GSE storage area

This area enables storage of Ground Services Equipment (GSE) equipment including airside buses. It is calculated on the basis of the number of aircrafts stands.

Some of the ground handling equipment needs covered storage, but other equipment can be left outside. The total necessary area is split between covered storage and uncovered storage according to the table below.

We take into account:

- 100 m² of covered storage for each narrow body stand and 200 m² for wide bodies,
- 150 m² of uncovered storage for each narrow body stand and 400 m² for wide bodies,

	2014	2034
Covered storage	1 544 m²	3 300 m²
Uncovered storage	2 715 m²	5 850 m²

Ramp offices will be included in the terminal area.

For ultimate development, it is necessary to have 4 500 m² covered and 7 600 m² uncovered.

6.3.4.2. Car parks

The car park will include space for private cars, a part employees cars, taxis, buses (especially hotel coaches), car rental…

According to Dabolim airport operators, Dabolim parking lot is currently saturated with :

- 150 motorcycle positions for an actual demand of 250,
- 8 bus positions for an actual demand of 25,
- 84 car positions for an actual demand of 200.

For the purpose of the evaluation of the Mopa requirements, we assume that taxis, bus and car rental needs should stick to the traffic and have a proportional growth.

There is currently a fast growth of the number of personal vehicles in the state of Goa. The requirements for Mopa airport car park and motorcycle park must then into account that the need for car park will grow according to the traffic but also with the ratio of vehicle/inhabitant of the state.

In the last decade, population in Goa state has been growing with a yearly increase of 1,4%, but, according to statistical data the number of vehicles has been increasing drastically faster. We will then take into account a growing number of passengers and employees using their own vehicle instead of public transport according to the following table.

	Motorcycles/inhabitant	Car/inhabitant
2003	20%	5%
2014	30%	8%
2034	34%	14%

A supplement of 10% will be added to car park needs to take into account car rental area.

The results of the calculation are given in the following table.

	Car park	S	Motos	S	Taxis	S	Bus	S	Total
2014	797	23917 m²	897	4486 m²	70	1748 m²	58	5826 m²	36000 m²
2034	4699	140733 m²	3436	17188 m²	184	4601 m²	153	15336 m²	178000 m²

For ultimate development, it is necessary to have 318 000m².

6.3.5. Technical area

The technical area includes the following functions appropriately spread over the airport.

Control tower and technical block

The tower height is set according to visibility rules (visibility line to any point of the runway(s) and the movement area must have an angle over 1% with the ground slope). The height defined is 40 m.

The tower will be equipped with a technical block and a dedicated car park for a total area of 3 000 m² (2014 and 2034). Its accessibility will be restricted to authorized employees only.

Maintenance workshop

These facilities include the airport maintenance workshops, the landside and airside equipment garage and the general warehouse. They offer storage for the spare parts and maintenance equipment necessary for maintenance of airports facilities and vehicles.

The area is a function of the number of aircrafts movements/year.

	2014	2034
Building floor area	4 369 m²	10 847 m²
Land requirement	5 461 m²	13 559 m²

The floor area of the building is : 1 m²/6 movements,
The global land requirement is 2,5 the floor area (2 levels-buildings).

30% of this area should be located inside the security area (lighting workshop, boarding bridges workshop, baggage sort workshop, airside equipment garage…).

Both public and security area facilities should be located near the vehicle security point.

For ultimate development, it is necessary to have 18 000 m² of land area.

Power supply

A 10 000 m² area will be sufficient for ultimate development. For 2014 and 2034, it is necessary to have 8 000 m2. This area includes the electrical plant and the surrounding facilities (parking lot and offices building). It will be located in the public area.

Catering and aircraft interior cleaning

The catering facilities provide on-boards meals and beverage, mainly for international passengers undergoing multi hours flights. The aircraft cleaning facilities include laundry and non consumable goods furnishing in the aircraft.

In case of several catering/cleaning operators, the overall requirements will be supposed to be shared between these operators.

In Goa airport, there is a mix of international and domestic traffic.

On the basis of :

- 2 000 m²/Mpax international for the floor area of the building and 6 000 m²/Mpax international for the area,
- 650 m²/Mpax for the floor area of the domestic/short haul passengers and 2 000 m²/Mpax domestic for the area,

It is then necessary to have:

	2014	2034
Buiding floor area	2 839 m²	6 994 m²
Land requirement	8 620 m²	21 262 m²

The catering facilities should be located on the boundary between security area and public area in order to allow direct transfer of meals through the building according to specific security procedures. This enables to avoid a path via the vehicle security point, which may lead to delay.
For ultimate development, it is necessary to have a land area of 29 000 m².

Fuel farm

The dimensioning of the fuel farm takes into account two main parameters:

- the average daily consumption of aviation fuel according to the departures,
- the storage capacity, which may vary according to the type and reliability of the supply means and reserve policy.

Due to the unavailability of fuel pipes or harbour, the refuelling will be made through trucks. We will base the calculations on a 2 weeks storage (the range is usually 7 to 20 days).

This calculation takes into account needs for JET A-1 as well as for AvGas used by general aviation aircraft.
The area provided is 1,4 m² for 1 m^3 of fuel.

	2014	2034
Storage volume	4 200 m²	11 300 m²
Land requirement	5 880 m²	15 820 m²

For ultimate development, it is necessary to have a land area of 22 400 m².

Fire protection

As the critical aircraft expected is the B 747, the fire protection will have a minimum declared level of 9 (planes with a length between 61 and 76 m and with a maximum width of the body of 7 m). This level is sufficient for the type of planes coming into the airport even for the long term. If it ever happens that A380 (length of 73 m but fuselage of 7.14 m width) or another new constraining aircraft come on the airport, an upgrade to category 10 will be necessary.

The location of the fire station must offer roads or circuits that allow access to runway ends and any other part of the aeronautical infrastructure in 2 minutes (3 minutes maximum) with regular conditions for visibility and pavement.

The facilities will be sufficient for the firemen to stay operational in appropriate conditions and to protect the equipment.

For level 9 of protection, it is necessary to have at least 3 fire protection vehicles. On the basis of data from other international airports with category 9 or 10, it is necessary to have an area of 8 000 m² for the facilities (including fire station with fire protection products storage, fire trucks and emergency vehicles garage and surrounding infrastructures) and an equivalent area for training (team organization around an immobilized aircraft, fire fighting, sport field…).

The total necessary area is then 16 000 m² (2014 and 2034). It will be located inside the security area. For ultimate development, 32 000 m2 has to be reserved.

Due to the far location of the airport from any urbanized or industrial area, the Airport Fire Fighting Services will also be in charge of fighting against fire occurring in buildings or landside facilities.

Meteo station

An area of 1 000 m² for the station, the measuring equipment area and the associated car park will be reserved (2014 and 2034). It will be located in the public area, near the ATCT.

Custom and police auxiliary facilities

An area of 1 500 m² (2014) and 3000 m2 (2034) dedicated to government services will be provided. This need includes detention area, dogs center (explosive detection training, drugs detection training…), offices building and associated car park. It will be located in the public area.

For ultimate development, 4 500 m² has to be reserved.

Custom and police will also have offices inside the terminal.

Water supply

Considering the elevation of the airport site in comparison with the surrounding area, it is very likely that a water tank with pressurizing equipments (or an elevated tank) will be necessary.

An area of 500 m² will be necessary for this tank in the public area (2014 and 2034), and 800 m2 for ultimate development.

An area of 1000 m² is required in order to implement water filtration facilities for potable water (2014). 2 500 m² will be required for ultimate development.

Drainage and sewage, waste water, wastes

The Mopa site is composed of a dense volcanic rock that does not allow percolation of rain water. As such it will be major for the airport development to take into account the need to preserve sufficient path for water drainage. Especially, the flow must not be impaired in the great ditch located in the center of the area.

An appropriate treatment for drainage water (in complement of oil separators on the apron) or sewage water might also be necessary according to local regulation. An incinerator and garbage storage area will also be provided. It represents a total area of 5 000 m2 (2014) and 10 000 m2 (2034).