BIAL Response to AERA's CP 05/14-15 on 'In the matter of Normative Approach to Building Blocks in Economic Regulation of Major Airports'

8th December 2014

Contents

Proposal No. 1. Regarding Debt-Equity Ratio and WACC

a. The Authority proposes to follow a normative debt to equity ratio of 70:30 for the purposes of calculation of Weighted Average Cost of Capital with 30% equity regarded as ceiling (refer Para 3.3) and true up WACC at the end of the control period depending on the actual proportion of equity (net worth) in the capital structure (based on the balance sheet numbers from year to year).

b. The Authority notes that in this approach, truing up is required for (i) debt equity ratio and (ii) cost of debt.

BIAL Response:

According to BIAL, Debt Equity ratio is to be on actual basis rather than fixing a ceiling or having a Normative approach as each airport is independent and different in many aspects such as connectivity, local government requirements, passenger capacity, passenger requirements, requirement of various infrastructure facilities (Non aero, Cargo, Infrastructure etc.) from other airports influencing cost, revenue, efficiency levels and also funding requirements for expansion projects. This view is also supported by the Authority itself and can be justified from the following paragraphs included by the Authority in the normative paper (Emphasis added as required):

Expert citations on Normative approach to Building blocks in Economic Regulation – extracts from CP 5/14-15:

The following are extracts of various expert citations on adoption of normative approach as provided in CP 5/14-15

"Benchmarking Airports:

2.1. Developing norms is a part of the exercise of "benchmarking" of airports. The

Authority is aware of different benchmarking exercises like Airport Transport Research Society (ATRS), Civil Aviation Authority (CAA) just to name a few. ATRS publishes year- wise reports on airport benchmarking of over 220 airports around the world on different parameters. CAA has published, inter alia, "CAA Airport Operating Expenditure Benchmarking Report 2012, CAP 1060, in June 2013. In its literature review, CAA has listed various studies like Leigh Fisher Airport Performance Indicators 2011, Booz & Company European Airport Benchmarking Study 2012, Steer Davies Gleave Stansted mid Q6 Review. Prof Anne Graham, in her book "Managing Airports, 4th edition, 2013, Chapter 3 gives operational parameters for different airports and lists factors influencing costs, revenues and efficiency levels.

According to Prof Graham,

> ***There is no 'typical' airport when it comes to looking at the services and facilities provided. Beyond the basic operational functions, different airports have little in common. The level of direct involvement will vary, with some airport operators providing activities such as security, air traffic control, handling, car parking, duty free shops and cleaning, while others will contract these out. In the extreme case, terminals may also be leased, as is the situation in the United States. All this will have an impact on both cost and revenue levels****. For example, Vienna airport generates over 30 per cent of gross revenues from handling. This is very different from airports, such as London Heathrow and Amsterdam Schiphol that generate a relatively small amount of revenues from this activity in the form of rents and concession fees paid by the airlines and handling agents. Handling services may even be produced jointly, for example with the airport supplying the check-in desks and the airlines staffing the desks. In some cases the situation may be even more complicated - the government may pay for the provision of certain services, as is typically the case with the provision of policing, security or fire and rescue.*
>
> *Economic comparisons in any industry must acknowledge the accounting*

policies adopted by individual operators. Within the airport industry, accounting procedures vary considerably, particularly as some airports adopt government or public Authority accounting methods rather than commercial practices. With government-owned airports it is possible, for example, to find that the airport's land will not be considered to be an airport asset, and hence will not appear in any balance sheet. Views differ on how assets should be depreciated. For example, Zurich depreciates buildings for 40 years, Amsterdam for 20—40 years, Copenhagen 80 years. At Dublin, runways are depreciated for 10-50 years, at Amsterdam for 15-60 years, and at Copenhagen for 80 years. Airports are subject to different taxation regimes, with many public sector airports, for instance those in the United States, being exempt from most business taxes. This will have an impact on any comparative analysis of net profit levels.

2.2. Prof Odoni cautions about transferring practices from one region to another and that that "best practices" of one region may not be readily transferable to another. Airports Council International, in its "ACI Guide to Airport Performance Measures", (Oliver Wyman, Feb 2012)1 lists the issues related to airport benchmarking. ***According to ACI, "Internal benchmarking, where an airport compares its performance with itself over time, is less complex than external benchmarking because the number of variables that change at an airport from one year to another is limited".*** *It recognizes the difficulties in airport benchmarking thus:*

> ***Airports are complex sets of businesses, and different airports operate in very different physical, financial, and governance environments. To make useful comparisons among airports, it is essential to compare similar sets of businesses operating in similar environments—which is easier said than done. When comparing one airport to another, some of the typical factors that drive different results and should be***

considered in making comparisons include: passenger volume, capacity constraints, mix of international and domestic traffic, mix of local and transfer passengers, mix of passenger carrier service (network, low cost, charter), mix of passenger versus cargo activity, degree of outsourcing, range of services provided by the airport, airport development program status, weather conditions, geographic location, urban versus rural location, physical size of the airport, public transportation access and usage, regulatory environment, local labour conditions, and ownership and governance structure

The Authority has also noted that benchmarking tool has been generally applied to the individual "processes" at the airports (time for the first bag to arrive from the aircraft to the belt etc.) **The Authority therefore concludes that while developing the norms for airport performance or its economic regulation, particular attention needs to be given to the objectives that the airport infrastructure is expected to fulfill and its relevance to the stakeholders"**.

Following Points can be noted from the above excerpts which the Authority itself has provided in the approach paper:

- Different airports in India adopt different models of conducting business and the operational requirements and environment within which they work significantly differs when compared one airport to another.

  For instance certain revenue functions like Cargo business, Retail business (Duty free) operations, Advertisement, Parking operations, Information technology operations etc. are either completely being run by the airport themselves or outsourced or same being run through joint venture business. There are certain operational functions such as Information technology departments, landside traffic management and car park functions etc. are

either completely being run by the airport themselves or outsourced.

It can be understood from the above that the generation of cash flows will be different between various airports and 'one norm fits all' may not be practical solution to the funding requirements of the airports.

- The operating environment and airport functioning requirements of various Indian airports differ completely between themselves. For ex: Congested airports vs. Non congested airports, Government run airports vs. Public Private Partnership (PPP) airports.

  The operational priorities of these airports differs to the large extent wherein resulting into varying impact on infrastructure facilities, expansion requirements, operational cost of running airport, maintaining service quality levels etc.

  Further the profile of the passengers, passenger volumes, peak hour patterns, passenger expectations, local government expectations & requirements, type & mix of aircraft operated by various airlines, hub vs. non hub airports etc. influences and impacts the functioning and operating of the airport and its priorities.

- The growth of traffic and requirement of airports to create additional infrastructural facilities, so as to cope with growth, significantly differs between various airports in India. For instance BIAL is in continuous expansion mode, as compared to other airports, due to exponential growth in traffic. In such growth scenarios the cash flow requirements and additional fund requirements will differ between various airports.

Conclusion:

As discussed above the actual & estimates of debt equity ratio of different

airports may not be same and may differ depending upon funding requirements and as well as cash flow availability. Further the conduct of the business and the functional and operating requirements of airports is dissimilar hence one single norm across various airports will not enable the airport to function efficiently.

CERC Norms: Authority approach and considerations of CERC norms while arriving at the proposal:

The relevant extracts of CERC norms are reproduced below for necessary considerations:

Short Title and Commencement: *(1) These regulations may be called the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2014.*

(2) These regulations shall come into force on 1.4.2014, and unless reviewed earlier or extended by the Commission, shall remain in force for a period of five years from 1.4.2014 to 31.3.2019.

Provided that where a project or a part thereof, has been declared under commercial operation before the date of commencement of these regulations and whose tariff has not been determined till that date, tariff in respect of such project or such part thereof for the period ending 31.3.2014 shall be determined in accordance with the Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2009 as amended from time to time.

Further sub Para 3 and 4 of Para 19 of Chapter – 4 Computation of Capital cost and Capital Structure of Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2014 states that:

(3) In case of the generating station and the transmission system including communication system declared under the operation prior to 1.4.2014, debt equity ratio allowed by the Commission for determination of tariff for the period ended 31.3.2014 shall be considered.

(4) In case of the generating station and the transmission system including communication system declared under the operation prior to 1.4.2014, but where debt equity ratio has not been determined by the Commission for determination of tariff for the period ended 31.3.2014, the Commission shall approve the debt equity ratio based on actual information provided by the generating company or the transmission licensee as the case may be.

Based on the perusal of CERC extracts, the following points require necessary consideration from Authority's end:

- Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2014 shall be applicable for Projects on or after 1.4.2014.
- Shall remain in force for the period of five years from 1.4.2014 to 31.3.2019 unless extended by the Authority.
- In case of Projects declared under the operation prior to 1.4.2014, debt equity ratio allowed by the Commission for determination of tariff for the period ended 31.3.2014 shall be considered for the next control period.
- In case of Projects declared under the operation prior to 1.4.2014, but where debt equity ratio has not been determined by the Commission for determination of tariff for the period ended 31.3.2014, the Commission shall approve the debt equity ratio based on actual information provided.

As it can be observed from above that due consideration been accorded by CERC regarding status of operation / execution of the respective projects while arriving at above normative proposal where as such an approach not been observed at AERA's end.

CERC approach and AERA approach differs in many ways and a few have been explained below:

- CERC Norms applies for the projects commenced on or after 1.4.2014 and not retrospectively whereas AERA proposes to apply even for existing airports.

- The approach of CERC towards return on equity is independent with a pass through of interest cost whereas AERA applies weighted average cost of capital (WACC) on net RAB wherein the combination of interest cost and RoE being arrived at and applied.
- CERC applies Debt Equity ratio norms on individual asset/project basis whereas AERA proposes for Company as a whole.
- AERA has proposed true up mechanism wherein certain penalties are intended to be imposed on airport operator whereas such approach is not envisaged/considered by CERC while recommending the adoption of debt equity ratios. Hence this proposal of AERA in terms of imposing penalties has to be dropped all together.
- AERA's approach of normative debt equity ratios appears to have drawn from the approach of CERC towards electricity regulations however there is no precedent, as suggested by AERA, in normal RAB based airport regulation.

Adoption of CERC norms to airport sector are not relevant as each airport is independent and different in many aspects such as geographical conditions, connectivity, local government requirements, passenger capacity, passenger requirements, various facilities (Non aero, Cargo, Infrastructure etc.) from other airports unlike power projects which are homogenous and similar.

Conclusion:

As discussed above CERC Norms and AERA Norms differ in many ways whereas it appears that AERA adopted CERC approach in electricity regulation without due consideration to unique challenges and requirements of airport sector.

AERA's approach of adopting normative debt equity ratio particularly imposing of penalties has no precedents and quite different from that of CERC approach. The approach of AERA creates more hardship and obstacles in airport regulations instead of positively enabling the airport operators.

Brief Note on BIAL Project and Key points from Concession agreement, State support agreement and other Project agreements on Project Financials – no normative approach considered:

Introduction:

Brief background to the BIAL project from bidding stage to awarding of project, funding of initial expansion, basis of state support assistance (viability gap funding) and basis of financials as considered by the Authority in its tariff determination are deliberated as below:

Background:

The award of BIAL project was through global bidding process. Initially two bidders were shortlisted and finally Siemens led the consortium was awarded the project after due evaluation of airport development plan and requirement of state support assistance (viability gap funding).

Accordingly all project agreements such as Concession agreement, State support agreement, Shareholders agreement, Financial closure agreements were entered into.

The concession agreement provides complete freedom to the airport operator in terms of raising adequate financials for the successful operation of the project. Concession agreement also envisages the creation of Independent Regulatory Authority (AERA) and also explicitly provides that IRA will support the fundamental assumptions on the basis of which initial financial closure of the project has been achieved (refer clause 10.2.1 – 10.2.4 of Concession agreement).

The State support agreement provides the quantum of state support (viability gap funding) in terms of refundable loan of Rs 350 crores, which has been arrived at basically on the basis of financial plan which is integral part of the awarding of the

airport project to successful bidder and SSA agreement. The brief financials which has formed part of arriving at State support assistance and also part of financial closure of initial phase are provided in the SSA (refer Annexure III of Amendment SSA dated 20th June, 2006). As it can be understood from the agreement that Equity IRR of 21.64% and Project IRR of 14.58% was assured for the project by the project agreements and which were signed by respective Central and local State government. While arriving at the respective project financials and State support assistance no normative approach being adopted by the governments and complete freedom being assured for the airport operator.

Conclusion:

BIAL request Authority to consider the following points from the above discussions:

- BIAL was the first Public Private Partnership model (PPP model) in the Country. All project agreements were approved by the highest Authority of the respective Central and State governments. All project financials were considered including Equity IRR and Project IRR for the entire Concession period.

- The project financials as considered as part of project agreements and project financial closure as achieved with the project lenders does not consider adoption of normative approaches in terms of debt equity ratio, return on equity etc.

- On the above basis, we request the Authority not to adopt a norm for Debt Equity ratio and truing up of the same as the terms and conditions have already been evaluated and finalized in the Concession agreement which were approved by central and state governments.

- From the airport opening date the project expanded its capacity significantly and significant amount of debt were raised both at the time of Initial project financial closure and also at the time of T1A (existing terminal) expansion project. Significant commitments were made to the lenders and also substantial risks were taken by the airport operator. In lieu of this BIAL request the Authority to consider actual debt equity ratio instead of normative approach of arriving debt equity ratio. Further determining such Debt Equity ratio will only discourage the private Investors from entering in PPP models of

Airport sector.

BIAL in midst of huge expansion requirements – normative debt equity approach to impact cash flow commitments & results into funding constraints:

Initial Phase of the Bengaluru International Airport was designed for handling about 4.5 million passengers per annum. However, owing to significant increase in aviation traffic, BIAL redesigned the initial phase midway through the implementation of the project, increasing the capacity of the Airport to 11.4 million passengers per annum and further demand may go up to 20 million passengers per annum from 2017-2018.

Considering the above expansion plan, In the Consultation paper no. 22/2013-14 BIAL has already proposed for future Capital expenditure of more than Rs.10,000 crores to be incurred over existing & next control periods for expansion plans of Terminal 2, Second Runway and related projects which are required to be funded between debt and equity as provided by the Authority.

From the below table of the tariff order of BIAL, it can be noted that the gearing ratio of BIAL in 2014-15 is 69.53% and in 2015-16 it is 65.44% and BIAL expects that the gearing ratio for future years will continue to be between 65% to 70% considering the future expansion plans of airport. With the proposed normative approach by the Authority BIAL will not be eligible to get the return on additional equity infusion beyond 30% of which BIAL is genuinely eligible. Hence we request the Authority not to determine a Normative Debt equity ratio for BIAL.

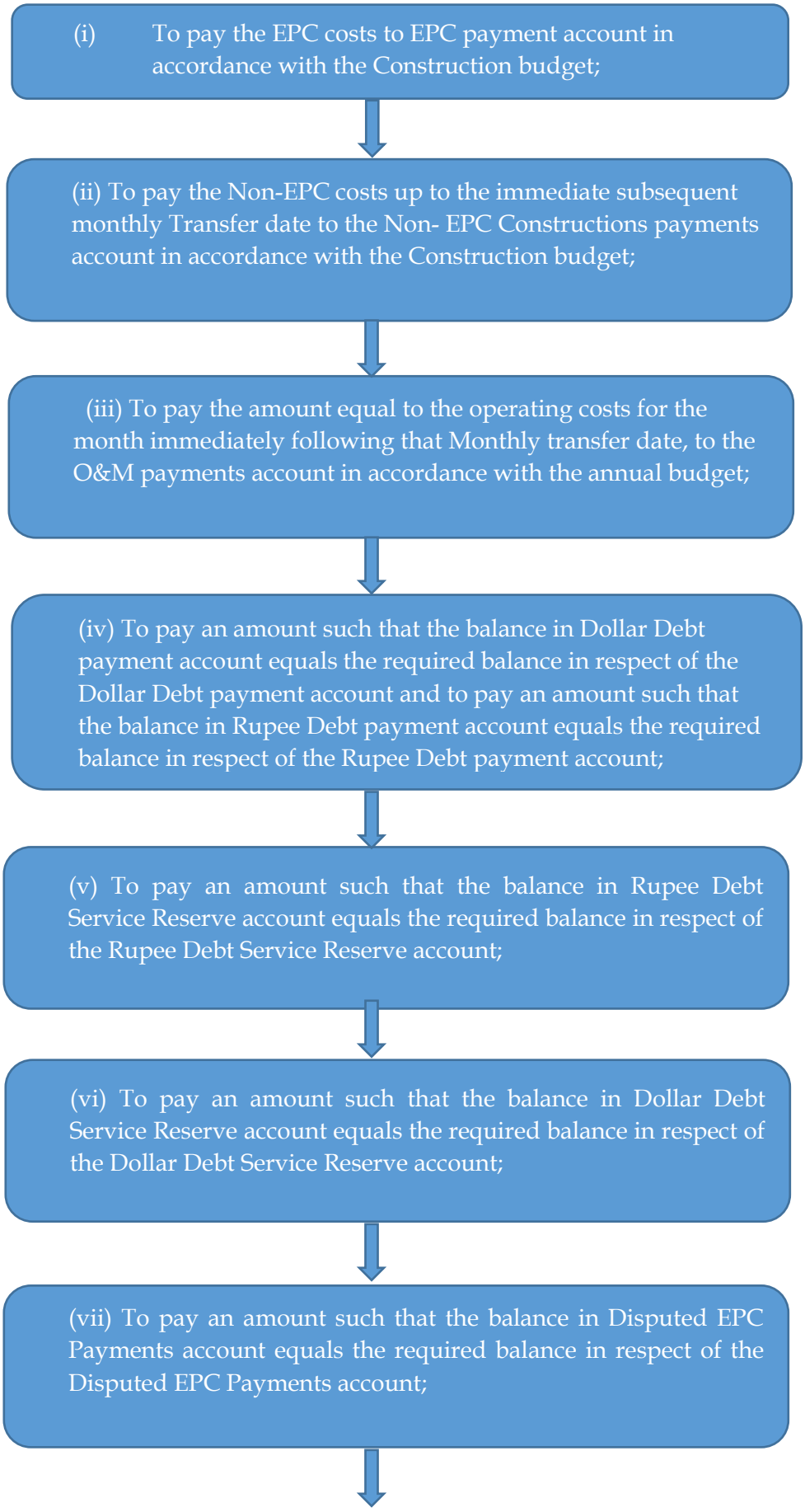
Table 59: Fair Rate of return computed under 40% Shared Revenue Till by the Authority – For MYTO

Particulars	2011-12	2012-13	2013-14	2014-15	2015-16
Average balance of Debt	1540.39	1805.67	2197.205	2187.895	2595.462
Average balance of Equity	522.65	656.31	725.83	959.0087	1370.82
Gearing Ratio	74.67%	73.34%	75.17%	69.53%	65.44%
Cost of Equity	16.00%	16.00%	16.00%	16.00%	16.00%
Weighted average gearing					70.92%
Weighted average cost of debt					9.73%
Fair Rate of Return					11.55%

Source: Table No.59 of the Order No.08/2014-15 issued by the Authority on 10th June, 2014.

We also place below the extract of our loan agreement on cash flow waterfall and prioritization, Priority Cash Flow Application:

As long as there is no event of default, the account bank shall, withdraw amounts from the proceeds amounts on each monthly transfer date in accordance with the Borrower's instructions and the operating procedures specified in annexure 2 only for the following purpose and in the following order of priority (hereinafter called "Priority Cash flow Application")


(i) To pay the EPC costs to EPC payment account in accordance with the Construction budget;
(ii) To pay the Non-EPC costs up to the immediate subsequent monthly Transfer date to the Non- EPC Constructions payments account in accordance with the Construction budget;
(iii) To pay the amount equal to the operating costs for the month immediately following that Monthly transfer date, to the O&M payments account in accordance with the annual budget;
(iv) To pay an amount such that the balance in Dollar Debt payment account equals the required balance in respect of the Dollar Debt payment account and to pay an amount such that the balance in Rupee Debt payment account equals the required balance in respect of the Rupee Debt payment account;
(v) To pay an amount such that the balance in Rupee Debt Service Reserve account equals the required balance in respect of the Rupee Debt Service Reserve account;
(vi) To pay an amount such that the balance in Dollar Debt Service Reserve account equals the required balance in respect of the Dollar Debt Service Reserve account;
(vii) To pay an amount such that the balance in Disputed EPC Payments account equals the required balance in respect of the Disputed EPC Payments account;

(viii) For transfer to the Distribution Holdings Account after the Payments specified in the sub clauses (i) to (vii) above have been made in accordance therewith.

Conclusion: With the kind of above situation where the Dividend distribution is at the end and considering the future expansion projections of BIAL, the way forward for dividend issue is a long term aspect. In spite of the above, if the Authority considers the normative approach of 70:30, will discourage the investors from making the investment in equity.

Further it is not at the option of BIAL to withdraw the equity in excess of 30% as there are numerous restrictions both in the Lenders agreement and in Companies Act, 2013 and Companies (Declaration and Payment of Dividend) Rules, 2014 for the payment of dividend as these statutory provisions require to declare dividend only after making provisions for past losses and transfer to reserves and others.

Authority proposal to consider debt return in case the Equity portion is in excess of 30% and to consider the actual respective return for calculating weighted average cost of capital and Truing up in next control period – Incorrect approach:

BIAL existing Debt equity ratio is at the optimal level and attaining & maintaining the 70:30 ratios as proposed by Authority is not possible due to reasons which are already mentioned above. Further BIAL is expected to infuse further equity and to generate more internal accruals, as part of AERA's approach in tariff determination order, considering the expansion plans of BIAL for second and third control period and investment in capital assets.

In lieu of above, Authority's proposal for giving the debt return in excess of 30% Equity portion is incorrect as funds which have already been applied in the projects cannot be pulled out and there are many constrains from Lenders, Companies Act,

2013 by which BIAL is not in a position to pull out the excess Equity portion.

Further Authority's proposal to give Debt return for the equity portion in excess of 30% and truing up process is incorrect as the Debt risk and Equity risk are predominately different. In practice, as the proportion of debt rises, both the cost of debt and the cost of equity also increase in tandem. The overall WACC is generally seen as falling until an optimal point is reached and rising thereafter. Hence, assuming that the norm is set at close to the optimal level, the total returns required will not lower as debt increases, and thus a truing up process is not required.

The Authority has proposed for debt to equity ratio of 70:30 on the basis of CERC. However as we have noted, there is no such methodology being followed Worldwide by any airport related regulatory authorities. The proposed Normative approach of allowing debt return for equity contribution beyond 30% is not fair as the risk perceptions of debt and equity differs predominantly.

Normative Approach of 70:30 Debt Equity Ratio Vs. 16% of Return on Equity using CAPM Model – Inconsistent approach:

The Authority is proposing normative debt equity ratio of 70:30 for tariff determination of Airport Operator. Further the Authority is determining 16% Equity Return based CAPM Approach.

The Debt Equity Ratio and CAPM Model are inter-related and dependent, whereas the Authority under normative approach is considering debt equity ratio of 70:30 based on CERC Norms and 16% Equity Return based on NIPFP Report (Observations on NIPFP Report is discussed in detail in further paras). If the Authority considers the debt equity ratio of 70:30, equity return under CAPM model using the said Debt Equity Ratio may not result into Equity Return of 16%.

Further, BIAL being an Airport required to make continuous expansion over future control periods required to infuse equity as well as debt to meet the requirement of future expansion activities such as Second Terminal, Second Runway etc., hence determination of 70:30 debt equity ratio on Normative Approach will result into inadequate returns to BIAL over future control periods.

Conclusion:

We submit to the Authority to consider the actual debt equity ratio instead of normative approach of Debt Equity Ratio of 70:30.

Overall Conclusion & submission:

- The expert citations, as provided by AERA itself in CP, support the view that no airport is typical in terms of services & facilities provided. It also observes that Airports are complex sets of businesses, and different airports operate in very different physical, financial, and governance environments. Authority himself concluded that benchmarking approach generally applied only to the individual processes at airport and hence specific attention needs to be provided to the individual objectives of respective airport to be fulfilled and its relevance to the stakeholders.

  In lieu of above the actual debt equity ratio and expected debt equity ratio of different airports may not be same and may differ depending upon funding requirements and as well as cash flow availability. Further the conduct of the business and the functional and operating requirements of airports is dissimilar hence one single norm across various airports will not enable the airport to operate efficiently.

- CERC Norms and AERA Norms differ in many ways which have been explained in above paragraphs whereas it appears that AERA adopted CERC approach in

regulating electricity.

AERA's approach of adopting normative debt equity ratio particularly imposing of penalties has no precedents and quite different from that of CERC approach. The approach of AERA creates more hardship and obstacles in airport regulations instead of positively enabling the airport operators.

- The project financials as considered as part of project agreements and project financial closure as achieved with the project lenders does not consider adoption of normative approaches in terms of debt equity ratio, return on equity etc.

  From the airport opening date the project expanded its capacity significantly and significant amount of debt were raised both at the time of Initial project financial closure and also at the time of T1A (existing terminal) expansion project. Significant commitments were made to the lenders and also substantial risks were taken by the airport operator.

  On the above basis, we request the Authority not to adopt a norm for Debt Equity ratio and truing up of the same as the terms and conditions have already been evaluated and finalized in the Concession agreement which were approved by central and state governments. Further determining such Debt Equity ratio will only discourage the private Investors from entering in PPP models of Airport sector.

- BIAL is in midst of huge expansion requirements and facing severe cash flow constraints. With the kind of above situation where all the internal accruals are expected to be utilized towards expansion plans, the way forward for dividend issue is a long term aspect.

Further it is not at the option of BIAL to withdraw the equity in excess of 30% as there are numerous restrictions both in the Lenders agreement and in Companies Act, 2013 and Companies (Declaration and Payment of Dividend) Rules, 2014 for the payment of dividend as these statutory provisions require to declare dividend only after making provisions for past losses and transfer to reserves and others.

In spite of the above, if the Authority considers the normative approach of 70:30, will discourage the investors from making the investment in equity.

- Authority's proposal for giving the debt return in excess of 30% Equity portion is incorrect as funds which have already been applied in the projects cannot be pulled out and there are many constrains from Lenders, Companies Act, 2013 by which BIAL is not in a position to pull out the excess Equity portion.

  Further Authority's proposal to give Debt return for the equity portion in excess of 30% and truing up process is incorrect as the Debt risk and Equity risk are predominantly different. In practice, as the proportion of debt rises, both the cost of debt and the cost of equity also increase in tandem. The overall WACC is generally seen as falling until an optimal point is reached and rising thereafter. Hence, assuming that the norm is set at close to the optimal level, the total returns required will not lower as debt increases, and thus a truing up process is not required.

- The Authority has proposed for debt to equity ratio of 70:30 on the basis of CERC. However as we have noted, there is no such methodology being followed Worldwide by any airport related regulatory authorities. The proposed Normative approach of allowing debt return for equity contribution beyond 30% is not fair as the risk perceptions of debt and equity differs predominantly.

- The Debt Equity Ratio and CAPM Model are inter-related and dependent, whereas

the Authority under normative approach is considering debt equity ratio of 70:30 based on CERC Norms and 16% Equity Return based on NIPFP Report (Observations on NIPFP Report is discussed in detail in further paras). If the Authority considers the debt equity ratio of 70:30, equity return under CAPM model using the said Debt Equity Ratio may not result into Equity Return of 16%.

Proposal No. 2. Regarding fair rate of return on Equity

a. The Authority proposes to consider fair rate of return on equity (Shareholders funds, sometimes called Net Worth) at 16% as reasonable and on normative basis.

BIAL Response:

BIAL submits to Authority that an appeal against tariff order issued lying pending for hearings & adjudication with AERAAT tribunal and one of the major grounds of appeal is the cost of equity considered by AERA. Hence, BIAL requests Authority to consider above factor and not to arrive at final decision in the above proposal until Tribunal disposes of the pending appeal. The final findings of Tribunal can be considered by AERA while going ahead with above proposal as it may determine at their end.

Subject to above BIAL would like to bring the following various factors for necessary consideration by Authority while determining the above proposal:

Determination of rate of return on equity through CAPM approach – Authority's inconsistent approach as part of Ist control period tariff determination:

Kindly refer Order No.08/2014-15 issued by the Authority on 10th June, 2014 where in as part of Tariff determination, BIAL has already submitted KPMG report on Cost of Equity for the Airport. In the report KPMG had estimated a cost of equity at 27.9% under Single Till and at 28.3% under Dual Till for the First Control period and at 23.5% as per the Optimal Gearing Levels (60% gearing). However Authority considered NIPFP report wherein BIAL has submitted various observations and inconsistencies as below:

Risk Free Return:

Airport project is kind of Infrastructure project where one can expect returns only

after a long gestation period. NIPFP has considered daily average of GOI bonds for arriving at the risk free rate which typically demonstrate that the returns are available on every day which is not the case with Infra Projects.

When Finance Ministry is using 10 year weighted average bond yield (8.60%) as benchmark for depicting the performance of government securities as it can be observed in "Public Debt Management" reports. NIPFP shouldn't have considered daily average while arriving at Risk Free rate of return.

Source: www.finmin.nic.in/reports/PDM_apr__june_2012.pdf

NIPFP report considers the 10 year bond yield over the period January 1, 2001 to December 31, 2010. NIPFP has selected older period which has the lowest 10 year bond yield, instead NIPFP should have considered the latest period bond yield.

The KPMG report on cost of equity for BIAL also considers 10 year bond yield as risk free rate return as on 31st March, 2012 which is 8.60% alike Public Debt Management reports.

Risk Premium:

As stated in Clause 2.2 of by NIPFP report, Volatility in Indian Market is high as compared to west which shows the risk factor is high in Indian investment as compared to west.

The NIPFP report assumes default spread of 2.41% as Indian Market Risk Premium based on Mr. Damodaran' s report to compute Cost of Equity based on local currency sovereign rating of Ba1. The outlook of international rating agency as submitted as part of tariff consultation submissions:
S&P - BBB-

Fitch - BBB-
DBRS - BBB (low)
Moody's - Baa3
Dagong - BBB+

Moreover, the author Mr. Damodaran himself suggested Melded approach as most realistic approach for the immediate future (page 55).The extracts are mentioned below:

"We believe that the larger country risk premiums that emerge from the last approach are the most realistic for the immediate future, but that country risk premiums will decline over time. Just as companies mature and become less risky over time, countries can mature and become less risky as well.

One way to adjust country risk premiums over time is to begin with the premium that emerges from the melded approach and to adjust this premium down towards either the country bond default spread or the country premium estimated from equity standard deviations. Thus, the equity risk premium will converge to the country bond default spread as we look at longer term expected returns"

As defined in Mr. Aswath Damodaran's report
Equity Risk Premium = Base Premium for Mature Equity Market + Country Risk Premium.

The country's risk premium of India as per Melded approach has been computed at 13.35%. (Page 93 of the report). NIPFP ought to have considered the Equity risk premium of 13.23% in case of Indian investment instead of adding 2.4% of the default spread as the default spread does not factor the market volatility.

Accordingly as stated above, the risk premium as computed by NIPFP needs to be

relooked into and NIPFP when it has depended on Mr. Aswath Damodaran approach, the equity risk premium for Indian Market ought to have been considered @ 13.23%.

The understanding as given by the Authority that Bangalore Airport has monopoly existence because of non-competition within 150 Kilometers radius is not correct as explained below:

The word monopoly is incorrect for BIAL as it still faces stiff competition in the International Airlines Market and Hub Market with neighboring airports like Hyderabad and Chennai. With an improved road and rail connectivity and robust infrastructure between Bangalore to Hyderabad and Bangalore to Chennai it is difficult for the operator to attract the passengers as the time taken for travel to Chennai or Hyderabad from road or rail and airline is almost similar. For ex: If a passenger is travelling by a train called Shatabdi express from Bangalore to Chennai then the time taken is 4 hours and 50 minutes and a passenger travelling by airline has to spend almost same time considering long commuting distance requirement of mandatory check-in time etc., Therefore unless the airport operator and airlines provide efficient and better infrastructure with at an optimal price it will be difficult for BIAL to compete.

Re-leveraging the Asset Beta:

NIPFP has re-leveraged the Asset beta from 0.51 to 0.40 only by considering UDF which is part and parcel of way of obtaining returns without any concrete basis / calculation.
Accordingly re-leveraged beta as determined by NIPFP also requires fresh consideration.

Computation of Equity Beta:

For the purpose of computing Equity Beta, NIPFP has used a private transaction that has been executed between GVK and Siemens.

Based on the above the equity beta has been computed as computed below:
Market Value of Equity: Rs.4429 Crores
Total Debt : Rs.1619 Crores
Level of leverage: 1619 / (1619+4429): 0.27
Equity beta: 0.4/ (1-0.27) = 0.55

NIPFP ought to have considered points as mentioned below which substantially impact Equity Beta Calculations:

It is a Private or Individual transaction at respective party's incidence and this does not reflect the market price as the individual transaction cannot be taken as the basis. If the shares of the company were listed then the listed market price can be taken as a base for computing Market Value of Equity. Taking private transaction as a basis is incorrect as this doesn't reflect the market intention. Further in case of non-availability of listed price, book value is to be taken after some adjustments as may be required.

This transaction has been executed between GVK and Siemens to which BIAL is not a party. When BIAL is not a party to it, Equity Beta ought to have calculated considering book value of equity instead of Market capitalization as computed.

Sale of 14% for Rs.620 Crores doesn't mean 100% will fetch Rs.4429 Crores. The Market capitalization which has been done by third party used for investment doesn't reflect the complete market capitalization of the Company.

NIPFP report substantiates its selection of comparable airports for determination of asset beta with survey reports of ACI. The ACI report is being prepared for completely

different purposes and accordingly the same should not be used for deciding that Indian airports can be compared with developed countries airports. The ACI rankings are a measure of service quality of airports and not riskiness of airport asset. Contrarily, the stringent quality standards specified in Concession agreement calls for additional capex / opex to maintain the quality standards thus increasing riskiness of the airport asset.

Unlike developed countries, passenger growth has not been stabilized in the Indian Market, as trended recently Indian aviation industry has registered fluctuation due to economic situation in the country. This situation is unlike in the developed markets where the passenger traffic has been stabilized.

As a result of large population in India, the traffic volume of BIAL may be equivalent to some other airports in developed countries. However, traffic volatility and underlying factors of traffic growth (such as per capita income, GDP growth rate, and income and price elasticity) in these developed countries are different from those in India, which is an emerging market. Thus, riskiness of airport assets in India is higher than those in developed markets. Accordingly for the purpose of Comparison and computing of Equity beta, NIPFP ought to have considered only developing markets instead of considering developed and developing markets.

As explained above, assumptions used by KPMG in case of BIAL and Jacobs in case of HIAL are appropriate and assumptions as computed by NIPFP require to be revisited.

Also referred by the NIPFP the Equity Beta as computed by Jacobs in case of HIAL is 0.78 is same as computed by KPMG in case of BIAL.

Hence the Beta as computed by the NIPFP i.e. 0.55 needs to be relooked into and instead should have used 0.78 as computed by the KPMG in case of BIAL or Jacobs in case of HIAL.

Considering BIAL is risk free:

Smooth functioning of Airport doesn't mean that BIAL has not faced any risks or facing any risks. BIAL has faced many risks before and during the construction stage such as Connectivity from NH 7 to Airport, which finally has to be built in by the BIAL itself. Also Courts cases being fought for getting permission of Airport opening only few days prior to Opening date indicates various risks that were involved. As stated above, BIAL has its own risks which Authority / NIPFP ought to be considered in determining Cost of Equity.

Conclusion: As detailed above, various assumptions and computation used by NIPFP in determination of Cost of Equity is not appropriate for arriving at the return on equity at 16%, therefore we request the Authority to re-consider the NIPFP report while arriving at Cost of Equity for BIAL.

As explained above, Authority's approach of arriving at rate of Cost of Equity at 16% is inappropriate and BIAL requests to consider the determination of Cost of Equity at actuals. Hence the Authority's latest proposal of Considering Cost of Equity at 16% as a normative basis for all airports including BIAL will result into grossly inadequate returns.

We request the Authority to determine cost of equity on case to case basis and not on Normative approach.

BIAL Project Financials – Commitment by respective Central and State governments of adequate return on Equity:

The freedom provided to the airport operator in terms of raising adequate funding in line with expansion requirements and also the explicit commitment provided to

airport operator in terms of Equity IRR and Project IRR deliberated in the previous proposal of normative debt equity ratio.

In this regard BIAL would like to submit to the Authority that an Equity Internal Rate of Return @ 21.66% is already computed at the Financial Closure for arriving at the Viability Gap Funding as per the State Support Agreement (SSA) executed between Government of Karnataka and BIAL.

Further would like bring to the notice of Authority that Bangalore International Airport project is BOOT project for which a special purpose vehicle being created as BIAL. Accordingly the Concession agreement provides specific clauses for 'Terminal compensation' wherein specific treatment of refund of equity and debt arrived at. The specific treatment of refund of equity and debt vide concession agreement clauses 13.7.1 and 13.7.2 are re-produced below (specific emphasis added):

> *13.7.1 Unless terminated earlier in accordance with Article 4.3.1, Article 13.4, or by mutual agreement between the Parties in writing, this Agreement shall continue in full force and effect from its commencement in accordance with Article 4 until the thirtieth (30th) anniversary of the Airport Opening Date whereupon the term of the Agreement shall at the option of BIAL be extended for a further period of thirty (30) years, provided that the following Articles of this Agreement shall have no further force and effect from the thirtieth (30th) anniversary of the Airport Opening Date: 5.1.2 (Obligations of GoI), 5.5 (Existing Airport), 7.7 (Commissioning), 8.17.2 (Minimum Disruption), 10.2 (Airport Charges), and 15.5 (Change in Law). BIAL may at any time prior to the twenty-seventh (27th) anniversary of the Airport Opening Date, exercise the aforesaid option of extending the term of this Concession Agreement by another thirty (30) years. In the event of BIAL not exercising its option of extending the term of this Concession Agreement, then* ***the Concession Agreement shall expire on the thirtieth (30th) anniversary of the Airport***

Opening Date and GoI or its nominee shall acquire all of BIAL's rights, title and interests in and to the Airport in the manner set forth in Article 13.5 on payment on the Transfer Date to BIAL the aggregate of:

(i) one hundred per cent (100%) of the par value of the issued, subscribed and paid-up share capital of BIAL; and

(ii) one hundred per cent (100%) of the Debt.

13.7.2 In the event of extension of the term of this Agreement under Article 13.7.1, the Parties shall commencing from the expiry of the fifty-fifth (55th) anniversary of the Airport Opening Date, initiate dialogue to extend the term of this Agreement on mutually acceptable terms and conditions. If the Parties are unable to agree upon the revised terms and condition of extension of the Airport by the expiry of the fifty-seventh (57th) anniversary of the Airport Opening Date, then, save as provided in Article 13.7.3 below, ***the Agreement shall expire on the sixtieth (60th) anniversary of the Airport Opening Date and GoI or its nominee shall acquire all of BIAL's rights, title and interests in and to the Airport in the manner set forth in Article 13.5 on payment on the Transfer Date to BIAL of one hundred per cent (100%) of the Debt.***

As it can be understood from above, Investors are entitled only nominal value of equity on expiry of 30th Year or return of NIL equity on expiry of 60th Year of the Concession Agreement as the case may be.

Conclusion: In view of above discussion, BIAL submits that its first PPP project and explicit commitments were made as part of Concession agreement and other project agreements by GoI & GoK. Also BIAL being BOOT project, the provisions of Concession agreement envisages specific treatment over return of Equity at the end of concession period which needs to be considered by AERA appropriately.

Hence, An Equity IRR of 21.6% considered while arriving at VGF by GoK and also in the

financial closure for initial phase and BIAL requests AERA to consider the same while arriving at Equity rate of return to BIAL.

AERA approach of tariff determination for Ist control period - Inadequate Return to BIAL – Impact on Future expansion:

BIAL witnessing the exponential growth of traffic and requirement of expanding the Airport capacity in terms of future expansions such as Second Terminal and Second Runway etc., got discussed in detail in the previous proposal.

Authority has considered the rate of cost of Equity at 16% and arrived at Tariff determination for first control period, however such approach has resulted into gross inadequate returns effecting the requirements of regular operations as well as future expansions of the airport.

The effective Equity rate of return for first control period translates into 8.37% as provided in the below table;

Amount in Rs. Crore		2011-12	2012-13	2013-14	2014-15	2015-16	Average
PAT	A	125.64	87.66	105.56	39.99	143.64	100.50
Equity							
Share Capital	B	384.60	384.60	384.60	384.60	384.60	384.60
Additional Equity Infusion	C	-	-	-	351.92	639.99	198.38
Reserves & Surplus	D	185.23	272.89	378.45	418.44	562.09	363.42
Total Equity	E=B+C+D	569.83	657.49	763.05	1,154.96	1,586.68	946.40
RoE	A/E	22.05%	13.33%	13.83%	3.46%	9.05%	10.62%
Proposed reduction in RAB (Table 111 of Order 08/2014-15, Page no 547 of 592)	F	-	-	-	53.29	62.85	23.23
Revised PAT	G=A-F	125.64	87.66	105.56	(13.30)	80.79	77.27
RoE	G/E	22.05%	13.33%	13.83%	-1.21%	5.30%	8.37%

- The average return to shareholder for I control period is 8.37% in spite of cost of equity assured by AERA @ 16%. The returns @ 16% provided by AERA is on net RAB resulting in low % of return to share holders

Conclusion: As it can be observed above, the Authority's approach of considering 16% as cost of Equity in first control period leaves little or no incentive for private investments into the BIAL. BIAL submits that it is not getting a fair rate of return for investment that is commensurate with the risks of BIAL. Any proposal to adopt normative approach of 16% return on equity will impact & jeopardize the future expansion plans of BIAL.

Overall Conclusion & Submission:

- BIAL submits to Authority that an appeal against tariff order issued lying pending for hearings & adjudication with AERAAT tribunal and one of the major grounds of appeal is the cost of equity considered by AERA. Hence, BIAL requests Authority to consider above factor and not to arrive at final decision

in the above proposal until Tribunal disposes of the pending appeal. The final findings of Tribunal can be considered by AERA while going ahead with above proposal as it may determine at their end.

- As explained above, various assumptions and computation used by NIPFP in determination of Cost of Equity is not appropriate for arriving at the return on equity at 16%, therefore we request the Authority that it should re-consider the NIPFP report while arriving at Cost of Equity for BIAL.

  As detailed, Authority's approach of arriving at rate of Cost of Equity at 16% is inappropriate and BIAL requests Authority to consider the determination of Cost of Equity at actuals. Hence the Authority's latest proposal of Considering Cost of Equity at 16% as a normative basis for all airports including BIAL will result into grossly inadequate returns.

  We request the Authority to determine cost of equity on case to case basis for respective airports and not on normative approach.

- BIAL submits that its first PPP project in the country and explicit commitments were made as part of Concession agreement and other project agreements by GoI & GoK. Also BIAL being BOOT project, the provisions of Concession agreement envisages specific treatment over return of Equity at the end of concession period which needs to be considered by AERA appropriately.

  Hence, An Equity IRR of 21.6% considered while arriving at VGF by GoK and also in the financial closure for initial phase and BIAL requests AERA to consider the same while arriving at Equity rate of return to BIAL.

- The Authority's approach of considering 16% as cost of Equity in first control period leaves little or no incentive for private investments into the BIAL. BIAL

submits that it is not getting a fair rate of return for investment that is commensurate with the risks of BIAL. Any proposal to adopt normative approach of 16% return on equity will impact & jeopardize the future expansion plans of BIAL.

Proposal No. 3. Regarding useful life of Assets and Depreciation

a. *The Authority proposes to lay down, to the extent required, the depreciation rates for airport assets, taking into account the provisions of the useful life of assets given in Schedule II of the Companies Act 2013 (Act 18 of 2013), assets that have not been clearly mentioned in the Schedule II of the Companies Act or may have a useful life justifiably different than what is indicated in the Companies Act, 2013 in the specific context to the airport sector. The Authority has initiated the process to enable it to issue a notification as appropriate, pursuant to the provisions Part B of Schedule II of the Companies Act 2013 for this purpose (refer Para 5.3).*

BIAL Response & Submission:

BIAL appreciates the Authority proposal to lay down the depreciation rates for the assets that have not been clearly mentioned in Schedule II of Companies Act, 2013 or assets that have not been clearly mentioned in the Schedule II of the Companies Act or may have a useful life justifiably different than what is indicated in the Companies Act, 2013 in the specific context to the airport sector.

We request the Authority to consider all the factors affecting the life of assets before laying down the depreciation rates such as for assets that have not been clearly mentioned like Runways, factors like Air traffic movements, weather, maintenance cost or re-carpeting cost and actual life of runways based on technical evaluation available with the all airport operators and other factors.

Further the Authority should also consider the cash flows for repayment of debt as these assets are being built by using debt funds partly and the depreciation as approved by the Authority should make sufficient cash available to the operator for meeting at least the debt repayment obligations.

Proposal No. 5. Regarding norms for capital costs

AERA's Proposal No 5 proposes the following norms for capital costs.

a. *The Authority expects that while finalizing the scope of future capital works, the Airport Operator would abide by the indicated norms. As illustration,*
   I. *IMG Norms for Terminal Building (for e.g., 25 m^2 per passenger for integrated Terminal Building*
   II. *Design criteria for Runway/taxiway/Apron (Airside works) as may be available in published literature on the subject (ICAO Documents, DG CARs as may be applicable)*
b. *The Authority proposes to consider capital costs of terminal building at a ceiling costs of Rs 65,000 per square meter or actuals whichever is lower.*
c. *The Authority Proposes to consider capital costs of Runway/Taxiway/Apron at a ceiling cost of Rs 7,000 per square meter or actuals whichever is lower (excluding earthwork up to the sub grade level). The expenditure on the earthwork will be carried out as per the CPWD methodology.*
d. *The Authority proposes to consider the capital costs of other works based on publicly available standard like the CPWD methodology (for Scheduled items CPWD schedule rates and for Market Items proper market rate analysis in line with CPWD framework and methodology)*

BIAL's submissions are as follows:

1. Introduction

1.1 In order to prepare the response to AERA, BIAL had visited the new airports in Chennai and Kolkata, held discussions with Airports Authority of India, met with the officials Cochin International Airport Limited which was widely referred to in AERA's CP. During the visit BIAL reviewed the extent of application of 2009 IMG norms airport strategy, planning, design and construction costs at these airports.

1.2 BIAL's has sought the clarifications from AERA via the letter dated 6 August 2014 on the various references mentioned by AERA in the CP. While BIAL appreciates AERA's response, it also wishes to note that the responses are general in nature and do not provide specific and substantiated information to support the proposal put forward in the CP.

1.3 BIAL had also engaged a specialist international consultancy, AECOM to undertake an independent Airport Benchmarking Study and Developing Guidelines for Capital Works in response to AERA's Consultation Paper No 5/2014-15. AECOM's Indian and International Aviation team have carried out an independent and professional benchmarking exercise on cost, quality of construction, correlation to passenger service levels and service quality at recently built airports in India including Chennai, Kolkata, Mumbai, Bangalore and New Delhi. AECOM's report is attached herewith for AERA's consideration. BIAL shall also be pleased to arrange a detailed presentation by AECOM to AERA.

2. Summary of BIAL's observations and recommendations.

2.1 Based on its own detailed analysis and the independent study undertaken by AECOM, BIAL wishes to summarize its observations as follows. These are

supported by a detailed responses as well as findings from AECOM's report.

2.2 BIAL believes that if the normative proposals are implemented in its current form, they will have adverse impact on safety, levels of services and passenger experience and quality of the airport infrastructure. Furthermore it will restrict the growth potential of BIAL and the development of large international standard airports in India. BIAL requests the Authority to take due consideration of BIAL's submissions.

2.3 The AERA consultation paper intends to introduce "one size fits all' approach. This will severely curtail the development of BIAL to international standards and will negatively impact BIAL's ability to compete in India and the global stage. When it comes to airport infrastructure, no two airports are the same because airport planning, design and quality and services provided will depend on airport's business strategy as to whether it is an Origin-Destination airport, Hub, LCC terminal, profile of its traffic, rate of growth, engineering and geological conditions, local conditions etc.

2.4 AECOM's detailed study confirms that Airport terminals are highly complex pieces of infrastructure and their configurations and layouts respond to the target markets and proposed levels of service but also reflect local constraints and challenges. For example, construction of a high international mix passenger terminal on a constrained terminal development site will require a different solution to the construction of a low international passenger mix terminal (dominated by domestic passengers) on a less constrained site. The outcomes in terms of area per mppa or peak hour passenger are likely to be very different for these two scenarios. Therefore flexibility in space provision and not 'one size fits all approach' is required to allow airport operators to respond to the local market and conditions.

2.5 This same fact has been very clearly acknowledged by AERA in BIAL's tariff order no 08/2014-15 paragraph 9.22 which is reproduced here, "The Authority

had noted that the cost of construction of T1A and associated works appeared to be high compared with the indicative past cost of construction of other Airports Terminals at Chennai, Kolkata, Cochin, Goa etc. The Authority was cognizant of the fact that the cost of construction depends on the scope of the work including specifications, design etc. Secondly, the authority noted that in these airports constructed by AAI (except Cochin which is a private airport), the costing was generally based on the engineering cost estimation principles as indicated in CPWD that are available in Public domain. The Authority also noted that the cost of construction in other airports as mentioned above, can be taken as indicative costs and these alone cannot be regarded as a basis or approved norm, to ascertain the reasonability of cost as the same has linkage with the scope of work, specification and design elements of the Project which may vary from airport to airport".

2.6 With regard to Unit Area Norms, the 2009 IMG Report referred to in AERA's CP too acknowledges that one size fit all approach cannot be adopted. The IMG reports states "An airport terminal should be capable of handling peak hour passenger traffic at the target level of service standard in the design year. The terminals should be sufficient not only for passengers processing but should be able to meet other requirements like travelers requisites, commercial activities, food courts, bank, post office etc. Different bodies / authors have suggested different values for Unit Area per php". It is for these reasons no international regulator or the long established international governing bodies such as IATA, ACI, ICAO have adopted any prescriptive "one size fits all" approach as envisaged in AERA's consultation paper.

2.7 AERA has suggested that integrated terminals in India should be constructed using the IMG norm of 25 sqm per Peak Hour Passenger (PHP). It is understood that this norm originated from AAI, although there does not seem to be any background analysis available on how this norm was derived, and therefore

how it should be applied. AECOM's study shows that without a clear basis showing how the 25 sqm/PHP has been derived and how it should be applied could result in misinterpretation and incorrect application by different airport operators. For example, some airport operators might assume that this norm applies to the total airport area, whereas others may assume that it applies to the passenger processing areas only.

2.8 AERA may note that there is already an answer to this problem of adopting a blanket 'top-down' area space standard across different terminal types at different locations with different operating models, goals, service standards and business objectives. There is an internationally recognized approach to airport terminal planning that can accommodate all this natural variability; this is enshrined in the IATA Airport Development Reference Manual (ADRM). The advantages to using the IATA method for defining the required space within a passenger terminal are very clear:

- It is the internationally recognized method;
- It is based on a clear and scientific 'bottom-up' methodology;
- It allows local traffic characteristics to be taken into account;
- It allows the space to be provided to vary according to target levels of service; and
- It is a methodology recognized and supported by airports key customers – the airlines.

The ADRM passenger terminal space calculation methodology is a 'bottom-up' process using locally specific parameters. However, ADRM also does give some 'top-down' guidance on the space that should be provided on a PHP basis. ADRM9 says that "Experience has shown that, when designing facilities for purely domestic or charter passengers, the corresponding maximum sqm/PHP figure should not exceed 25 sqm and 30 sqm respectively." ADRM10 indicates that 35m2/PHP should be provided for international passengers.

BIAL therefore recommends that international IATA Airport Development

Reference Manual (ADRM) should be used as the guide for terminal planning and unit areas planning.

2.9 2009 IMG Report very clearly acknowledges the need for airports to remain competitive. More specifically, the IMG Report states "The design and approach towards Airport Terminals has undergone a radical change. Earlier, a terminal was a building where a passenger commenced and concluded an air journey. In the present times, a lot more is expected from Terminal- not only it should be functionally efficient, it should also be aesthetically and architecturally appealing. It encompasses a wide variety of activities related to aviation leisure, comfort, shopping and business apart from Customs, Immigration, and Security etc. Comparison with a 'World Class' airports in neighboring countries is also a crucial factor in planning Airport Terminals".

2.10 With regard to Unit Cost of Construction, Authority may note that Airport facilities can reasonably vary in specification and price for a number of compelling reasons including traffic type, degree of peaking, facility specifications, the needs of users, and local costs and conditions etc. There is a wide range of such issues influencing the cost of airport terminals, most of which may account for legitimate differences between the costs of airport passenger terminals across India. It appears that AERA may not have accounted for all these factors while proposing INR 65,000 per sqm. Authority may also take note that the indexed construction costs expended for all the recently developed major airports in India show that construction cost varies from location to location and from trade to trade due to various factors as elaborated in the AECOM's report and is in the range of INR 112,000 – 148,000 per sqm, significantly above the suggested INR 65,000 per sqm..

2.11 As development costs vary due to timing of construction, physical location, customer base and more as mentioned above, there is no conclusive methodology to establish airport terminal costs norms on per sqm basis. The

key benchmark that is found comparable is cost incurred per million passengers per annum (mppa). ICAO also uses productivity/efficiency as a key 'Performance Indicator' for airports performance. As per ICAO cost effectiveness refers to the financial input or costs required to produce a nonfinancial output i.e. total cost per passengers. AERA should thus evaluate airports for their productivity and cost effectiveness and incentivise efficiency.

2.12 AECOM reports very clearly shows that when comparing mid size airports, **BIAL is the most cost efficient airport** at Rs 1075 per annual passenger . Whereas Cochin's new terminal is the least efficient at Rs 1121. AERA should thus evaluate airport terminal costs efficiency and reasonableness using "Cost per Passenger" using the terminal's design mppa capacity.

2.13 AECOM has attempted to estimate broad costs for construction of a terminal building based on CPWD methodology (base parameters that the construction industry references across the country). On the basis of this calculation, AECOM notes that the cost for an airport terminal building, including airport system related costs, range upwards of INR 149,000 per sqm and the cost of INR 65,000 per sqm, as recommended by AERA, is not feasible.

2.14 Based on BIAL's visit to Cochin Airport and discussions with officials, it is abundantly clear that Cochin Airport is not a valid comparator airport for benchmarking purposes. Cochin Airport handled approximately 5.4 million passengers in the 12 months ending March 2014 compared to Bangalore Airport which handled 2.4 times the passenger traffic for the same period. The key issue here is the market at Cochin Airport is completely different to the market at other airports in India and in particular BIAL. At Cochin there is a strong overseas worker passenger component not seen in such proportions at other airports in India, which reflects the difference in the prevalent market served by Cochin Airport and to some extent explains why the airport operator has chosen to provide a low cost functional facility without any major aspirations

for attaining high level of service standards. The airport authorities themselves market the airport as a pioneer in developing a low-cost and functional airport, while there is nothing wrong with that as it serves a particular market, translating that model to other larger airports in India may not be appropriate.

2.15 With regard to Unit Cost of Construction, again 2009 IMG Report too very clearly acknowledges that one size fit all approach cannot be adopted. The IMG report states "Construction cost is mainly driven by the target Level of Service Standards. The location is another important factor. The cost of construction generally increases by about 10% in difficult and remote areas".

2.16 IMG report concludes "In an airport terminal, the cost of construction is 'facilities' and 'finishes' driven. It is, therefore, imperative for planners to achieve a judicious balance between design specifications and cost associated with each element. 'Value for the Money should be the motto'. Since the architects, project engineers and contractors of a project may have the tendency to over-design and use expensive finishes, there should be some institutional check and balance for specifying an indicative / benchmark unit cost within which an airport should be designed and constructed. The cost of construction is, however, dependent upon various variables. It is easily impacted by location factors. Therefore, it may not be possible to lay down and general norms in this regard. It is, at the same time, important to benchmark the cost of construction across projects being implemented with similar planning horizon. IMG is of the opinion that for appropriate benchmarking, an in-house appraisal mechanism could be established in the Ministry of Civil Aviation. The Appraisal Committee established by MoCA should assess the reasonableness of the proposed unit cost of Airport Terminals costing more than Rs.150 crore. The Appraisal Committee should specify the ceiling unit cost and the architects/engineers of AAI should plan and implement the project within the ceiling, subject to revision on account of

increase in WPI. In the case of airports developed through public private partnerships, the project authorities may adopt a case by case approach with respect to norms relating to unit area and costs".

2.17 Authority may note that a similar process is already in place for BIAL where the review and oversight is performed by BIAL's Board. This is further supported and strengthened by AERA's specific guidelines for incurring capital expenditure in BIAL's tariff order no 08 / 2014-15 which is reproduced below:

Cost estimation – estimating the costs based on well-established principles like drawing up detailed bill of quantities for each element of the work, appropriate costs thereof as would be available for each element of the work, appropriate costs thereof as would be available in public domain. (One such detailed analysis and procedure of estimating the project cost is available in published schedule of rates of CPWD. CPWD publishes the standard items, its cost, (what is called as scheduled items) its applicable rate and its base year. CPWD also publishes the revised cost index to convert the scheduled items rate into a current rate equivalent. Apart from scheduled items, the project may contain some other items which may also need to be executed (what is called market rate items or non-scheduled items) namely Elevators, Escalators, Central Air conditioning plant, Walkalator, Passenger Boarding Bridge (PBB) or other non-scheduled items such as flooring, fittings etc. inside the Terminal Building. These are the non-scheduled items for which standardized rates are not available. In such cases, according to CPWD principles, market rate analysis needs to be carried out as per the CPWD procedure to arrive at reasonable cost estimates).

Stakeholder consultation – Detailed stakeholder consultation to be carried out for the need of the Project for each of the Project Proposed, wherein the stakeholders are given complete details of the Project, detailed scope, design, available alternates and its detailed cost estimates along with basis thereof. (Airport guidelines issued by the Authority indicate the various stages

in which the stakeholder consultation is to be carried out along with the various information to be provided including Project cost estimate, Capital cost, details of Operating expenditure, Forecast of cost and its other impact, Projected impact on the tariff, Projected implications for Airport Operations, Service level, Providing a Project Information file etc. – Refer Airport Guidelines)

Board's approval on scope, standard of work and the cost of the proposed Project (viz. Terminal 2, Site Preparatory works, Second Runway, Apron, Parallel Taxiway, Cross connect Taxiways, Other Airfield Development works Forecourts, Roadways and Landside Development etc.)

2.16 BIAL therefore submits to AERA that it does not support any arbitrary and restrictive approach of establishing ceilings for Area and Unit costs for the following reasons:

a. IMG Reports was issued in 2009 and needs to be updated. IMG report also does not recommend one size fit all approach. No AAI airports appear to have been built in full compliance with the said area norms.

b. AERA has not provided any detailed calculation for the Area or Unit Cost ceilings. Establishing unit cost ceiling using CIAL is incorrect since it is relatively a small O&D airport and positioned by its own management as a Low Cost Terminal whereas BIAL has to serve multiple market segments to establish itself as the Regional Hub. The construction of CIAL's low costs terminal has just commenced and the cost of Rs 43,333 per sqm indicated in the CP does not include complete fit out costs. The complete build out costs is estimated to be in the range of Rs 67,000 per sqm to 92,000 per sqm depending on the year of construction. Furthermore it is not an integrated Terminal which will require additional processors and facilities and therefore costs.

c. The proposed norms have the risk of constraining BIAL's ability to meet its concession agreement obligations specifically with regard to service levels. Furthermore "one size fit all" approach and will severely curtail BIAL's growth prospects and its ability to compete in India and in the global stage.

d. AERA has established very clear guidelines to BIAL for finalizing future project costs in its tariff order 08/2014-15. Furthermore the Authority also validates the reasonableness of area and costs by appointing its own independent auditors.

2.18 AECOM's independent and comprehensive study also supports BIAL submissions. AECOM's study draws the following conclusions:

a. There should be no "one size fits all" policy.
b. IATA ADRM is the International Standard Methodology for Airport Terminal planning.
c. Cochin Airport is not a Valid Comparator Airport for Benchmarking Purposes Airport Service Quality – It's Delivered Service and Customer Satisfaction that Counts.
d. A range of factors associated with site conditions and complexity of infrastructure mean that what is cost effective at one terminal may not be at another.
e. A ceiling rate for airfield pavements would not be suitable to fit all scenarios unless design norms are standardized in Indian context, the proposed ceiling costs of Rs 7000 per square meter for Runway/Taxiway/Apron is not justified.
f. Imposition of Space and Cost Norms increases the risks to the Airport

2.19 BIAL's recommendation to Proposal no 5 are as follows:

a. **With regard to area norm BIAL strongly recommends that international IATA Airport Development Reference Manual (ADRM) should be used as the guide for terminal planning and unit areas planning.**

b. **With regard to Terminal ceiling cost of Rs. 65000/sqm BIAL does not agree with proposed norms. BIAL recommends that AERA's guideline provided in the tariff order no 08 / 2014-15 clauses 9.46.1 to 9.46.3 should be adopted. AERA should evaluate airport terminal costs reasonableness and efficiency using a more objective measure of "Cost per Passenger" as per the terminal's design mppa capacity instead of costs per sqm**

c. **With regard to Runway/Taxiway/Apron ceiling cost of Rs 7000 per sqm BIAL recommends that normative design and specifications should be established along with the proposed unit cost. Appropriate cost adjustments should be made where there are deviations from the normative design and specifications.**

3. **BIAL's detailed comments on Proposal No 5a are as follows:**

AERA Proposal no 5a: The Authority expects that while finalizing the scope of future capital works, the Airport Operator would abide by the indicated norms. As illustration, i. IMG Norms for Terminal Building (for e.g., 25 m^2 per passenger for integrated Terminal Building,
ii. Design criteria for Runway/taxiway/Apron (Airside works) as may be available in published literature on the subject (ICAO Documents, DG CARs as may be applicable).

3.1 BIAL in its letter dated 6 August 2014 had requested Authority for clarity on 2009 IMG norm application and an example of integrated Terminal based on

25sqm/php constructed in India, designed for meeting various processors/functional spaces within the Terminal in compliance with IATA level of service C.

3.2 Authority in its response "Public Notice No 9/2014-15" states that IMG has specified the norm of 25 Sqm per passenger for integrated terminal (both domestic and international) and further Authority notes that IMG report recommends "value for money should be the motto" and that IMG reflects "international standards". Authority also mentions that "details of calculation are **not material** as IMG recommends overall area norm for planning purpose while assuming up to 20% for commercial services".

3.3 Authority has also stated that it is the Operators responsibility to plan for all passenger facilitation, functionality and safety and that BIAL could approach directly the airport authorities for clarifications.

3.4 Accordingly, BIAL has investigated with Airports Authority of India for application of IMG norm. BIAL has discovered that that this norm is used as a "guiding factor" for sizing of terminals, while the actual design is based on IATA's Airport Design Reference Manual (ADRM) to calculate peak hours and individual processors at AAI airports.

3.5 IATA ADRM 10th edition says that "experience has shown that, when designing facilities, the maximum SQM/PHP figure should not exceed 25sqm for purely domestic passengers, 30sqm for charter passengers and 35 sqm for international passengers." However, IMG norm recommends pure Domestic terminals with traffic above 1000 php should not exceed 20sqm/php and International Terminals shall not exceed 27.5sqm/php. This is far lower than the International standards and hence IMG norm cannot be referred as "international standards".

3.6 Furthermore on basis of Kolkata Tariff documents and discussions with Airport Authorities it is understood that 25sqm/php refers only to the passenger area of the Terminal and not the back of house facilities and spaces. The area /php for the entire terminal footprint will be higher. It is also clear on basis of Kolkata Minutes of Stakeholder Consultation Meeting that by the word "Integrated" IMG refers to a Terminal which houses domestic and International but not necessarily a Common Use Terminal which has shared facilities such as check in counters, Baggage handling system, departure lounge area, boarding gates etc. between Domestic and International.

3.7 Authority may note that the IMG norm was established in 2009 as guidance for AAI airports. None of the new major airports constructed by AAI recently have Integrated Terminals and furthermore even Kolkata has only a partially integrated airport.

3.8 Authority may note that several changes have occurred at Indian Airports and these new requirements need to be taken into account if IMG is to be used as a yard stick. Some of the changes at Indian Airports since 2009 that affect the area planning of Terminal:

1. Visa on Arrival for 180 Countries (July 2014)
2. 100% Screening for level 2 of the inline BHS system (Nov 2011)
3. Security screening at entry of Terminals (Aug 2011)
4. Dog Squads established at airports since (Jan 2011)

3.9 As IMG norm is established in 2009 and since then various changes to Airport operations and passenger requirements have occurred, IMG norm needs to be revised before referring it as a yardstick for future terminal designs.

3.10 Authority has specifically acknowledged that Airport Operator is responsible for providing all required facilities for passenger facilitation, functionality and safety. Therefore the Operator should be permitted to use IATA ADRM.

3.11 2009 IMG Report has not considered any international airports in arriving at the norms and hence they cannot be considered as international standard. However, IMG report section G clearly states that International best practices should be considered for establishing norms relating to area or cost for PPP projects. Hence if the AERA wishes to establish area norms for PPP projects, such norms should be established only after conducting a detailed benchmarking exercise including relevant international airports and making the report available for consultation. IATA latest ADRM version indicates average of 46sqm/php upon benchmarking airports across the world.

4. BIAL's detailed comments on Proposal No 5b & 5c are as follows:

Proposal no 5b : The Authority proposes to consider capital costs of terminal building at a ceiling costs of Rs. 65,000 per square meter or actuals whichever is lower.

Proposal no 5c: The Authority Proposes to consider capital costs of Runway/Taxiway/Apron at a ceiling cost of Rs 7,000 per square meter or actuals whichever is lower (excluding earthwork upto the sub grade level). The expenditure on the earthwork will be carried out as per the CPWD methodology.

4.1 Authority has not provide any rationale and detailed calculation on how the ceiling of Rs.65000/sqm for Terminal costs when most of the recently completed Terminals including that of AAI are in the range of Rs.1,10,000/sqm.

4.2 In this regard BIAL in its letter dated 6 August 2014, had requested the Authority for clarity on cost of Cochin new Terminal and Kolkata's new Terminal building referred to in AERA's consultation paper. BIAL has not received any detailed explanation.

4.3 BIAL had also requested Authority to clarify the "Quality" benchmarks advised for the fixed ceiling cost of Rs.65,000/sqm as capital expenditure is directly dependent on scope, engineering and specifications of the Project.

4.4 Authority has responded via "Public notice No 9/2014-15" mentioning that CIAL cost of new Terminal is considered on basis of its MYTP submission and Authority feels that CIAL subsequent cost of completion will be in the range of Rs.65,000/sqm. Authority further advised BIAL to approach CIAL and AAI for details deemed necessary.

4.5 BIAL as directed by the Authority has approached CIAL and AAI for details of their projects and development costs. AERA may note that CIAL cost for its new Terminal Building of Rs.650 Cr includes fit out costs for only half of its Terminal capacity in its first phase of works as per CIAL's stakeholder meeting presentation. Further CIAL intends to refurbish the Terminals for its ultimate capacity to be achieved in 2028/29 in the future. Thus BIAL notes that CIAL cost of Rs.43,333/sqm is incomplete when compared for the total capacity of the Terminal of 8.5mppa. The complete build out costs is estimated to be in the range of Rs 67,000 per sqm to 92,000 per sqm depending on the year of construction. Furthermore it is not an integrated Terminal which will require additional processors and facilities and therefore costs.

4.6 BIAL concludes that no Indian Airport Terminal in recent times has been completed with fixed ceiling cost of Rs.65,000/sqm to international standards referred in BIAL's Concession Agreement. Thus "Quality" standards expected with Rs.65,000/sqm will be similar to Cochin's new low cost, low quality

Terminal specifications. Airport development should be governed by productivity and cost effectiveness aspects and thus AERA should evaluate airport developments on cost per mppa basis rather than cost per sqm assessment.

4.7 Authority may note the "Benchmark cost study" conducted by AECOM which establishes the cost range for Terminal developments in India between Rs.1,12,000/sqm – 1,48,000/sqm for providing good International quality infrastructure.

4.8 Lastly as Terminal cost is dependent on various factors i.e. geographical, design specifications, etc and hence there cannot be a single cost for all Terminal developments within India unless there is a normative design and normative specifications established for all terminal developments.

4.9 With regard to the ceiling cost of Rs.7000/sqm for Runway/Taxiway/Apron pavement works BIAL study determines that it can be applied if there is a standard design with set specifications. Authority is requested to provide the specifications and designs for ceiling proposed. Variations from these design parameters or specifications due to Site specific conditions should be accommodated when arriving at final allowable costs.

4.10 BIAL endorses the view in IMG report Section G that in case of PPP airports a case by case approach with respect to unit area or unit costs needs to be adapted based on judicious consideration of International best practices and financial viability. AERA's recent tariff order to BIAL also stipulates detailed process for incurring capital expenditure including use consultation therefore further arbitrary normative measures are not required.

4.11 BIAL therefore does not support the need for establishing one size fits all area for cost norms especially for major international airports such as KIA.

BIAL requests Authority to maintain the guidance provided in sections in 9.46.1 to 9.46.3 BIAL's tariff order 08/2014-15 to finalise the future projects works.

Proposal No. 6. Regarding aeronautical and non-aeronautical asset allocation

a. The Authority proposes to make the aeronautical and non-aeronautical asset allocation (wherever necessary, refer Para 8.3) in 80:20 ratio for the Terminal Building and common use assets.

b. The Authority proposes to consider the cost of Airside operational assets (including operational boundary wall and roads) that are meant for aeronautical services.

BIAL Response:

The following is the extract of Norms and Standards for determining the capacity of Airport Terminals issued by Inter-Ministerial Group (IMG) in September, 2008 (Revised January, 2009)

E of Para 3 of Unit Area Norms –

"Overall space /area norm should be such as to provide a reasonable level of service for all components required in a Terminal Building. Commercial or Retail area providing amenities like food & beverages, book shops, counters for car rental, vending machines, public rest rooms etc. normally require 8-12% of the overall area, and should be planned and provided accordingly. In bigger airports, i.e., with annual passenger traffic exceeding 10 million, commercial area could be ***up to 20% of overall area"****.*

It can be noted from the above Para that the Non aeronautical space require is 8-12% of the overall area and could go up to 20% in case of bigger airports with the annual passenger traffic exceeding 10 million. However Authority proposal, by referring to IMG report, of determining the limit of Non aeronautical area/asset at higher end of 20% is completely inconsistent as the IMG report itself clarifies that it may go up to 20% of overall area.

Further in the recent orders issued by the Authority in case of DIAL, MIAL, HIAL and BIAL the allocation of assets between aeronautical and non-aeronautical assets considered by the Authority is as follows:

Particulars	Aeronautical Asset	Non Aeronautical Asset
DIAL	89.25%	10.75%
MIAL (13-14)	93.11%	6.89%
BIAL	87.70%	12.30%
HIAL (13-14)	83.09%	16.91%

The Authority has also stated in the respective orders to commission an independent study to assess the reasonableness of the asset allocation. It would be prudent for the Authority to consider the outcome of these independent studies so as to understand the individual pattern of the aeronautical & non aeronautical services, business revenues and its impact on asset allocation in respective airports.

Further there are many factors which influence the ratio of Aeronautical and Non-Aeronautical assets and which differs from one airport to another airport, following are the few factors listed below:

Factor	**Influence**

In house/Out sourced	If the airport operator is carrying out an activity on his own then the asset relating to such activity will appear in the balance sheet of airport operator and corresponding income and expenditure in profit and loss account whereas if the airport operator has outsourced such activity then the assets relating to such activity will not appear in the balance sheet of airport operator and corresponding expenditure will not appear in profit and loss account only the concessionaire share or revenue share or fixed rental will appear in the profit and loss account. Ex: Car Parking
Requirement of facilities - Passenger preferences	Passenger preferences in terms of requirement of facilities at each geographical area will be different, hence the investment in aeronautical and non-aeronautical assets depend on the passenger requirements at each airport.
International Connectivity / Passenger Volume	Investment in Aeronautical assets and non-aeronautical assets will also depends on the International Connectivity and Passenger Volumes for eg: Airports in Mumbai and Delhi which are having higher international connectivity and international traffic will be investing in non-aeronautical activities such as investments for duty free, food courts, forex, lounges, transit hotel etc., will be different from the investments in similar activities by other airports such as Bangalore and Hyderabad which are having lower international connectivity and international passenger volume will be different and cannot be compared.

Retail and F & B Propositions	Investment in Retail and F & B Propositions also depends on various factors such as outcome of the market study at each geographical location, business potential etc. which will determine the investment to be made by the operator in such activities.
Investment based on Airline Requirements	The requirement of local airlines operating from respective airport may prefer additional facilities depending upon their own and passenger convenience and accordingly airport operator may require to invest in these additional facilities. For example investment in certain Information technology service related assets like passenger tracking facilities to find the exact location of passenger such as security area, immigration area, duty free etc.,

BIAL also submits to Authority that an appeal against tariff order issued lying pending for hearings & adjudication with AERAAT tribunal and one of the grounds of appeal is on the approach & basis adopted by Authority regarding allocation of common assets between aeronautical and non aeronautical services. Hence, BIAL requests Authority to consider above factor and not to arrive at final decision in the above proposal until Tribunal disposes of the pending appeal. The final findings of Tribunal can be considered by AERA while going ahead with above proposal as it may determine at their end.

Conclusion & Submission: Authority's proposal of determining the limit of Non aeronautical area/asset at higher end of 20% is completely inconsistent with the IMG report as explained above. Also the actual allocation in various airports significantly differs with the above proposal and therefore we request the Authority not to have a normative approach of arriving asset allocation between aeronautical and non-aeronautical services and rather to consider the basis of independent studies which Authority already initiated and to determine asset allocation individually for each

airport.

BIAL also submits to Authority that an appeal against tariff order issued lying pending for hearings & adjudication with AERAAT tribunal and one of the grounds of appeal is on the approach & basis adopted by Authority regarding allocation of common assets between aeronautical and non aeronautical services. Hence, BIAL requests Authority to consider above factor and not to arrive at final decision in the above proposal until Tribunal disposes of the pending appeal. The final findings of Tribunal can be considered by AERA while going ahead with above proposal as it may determine at their end.

Proposal No. 7. Regarding allocation of O&M expenditure between aeronautical and non-aeronautical services:

a. The Authority proposes to make the allocation of O&M expenditure between aeronautical and non-aeronautical services (wherever necessary) in 80:20 ratio

BIAL Response:

In the recent orders issued by the Authority in case of DIAL, MIAL and BIAL the overall allocation ratio of O&M expenditure between aeronautical and non-aeronautical services considered by the Authority approximately is as follows:

Particulars	Aeronautical Asset	Non Aeronautical Asset
DIAL	89.00%	11.00%
MIAL (12-13)	88.00%	12.00%
BIAL	89.00%	11.00%

The Authority has also stated in the respective orders to commission an independent study to assess the reasonableness of the O&M expenditure between aeronautical and

non-aeronautical services. It would be prudent for the Authority to consider the outcome of these independent studies so as to understand the individual pattern of the aeronautical & non aeronautical business revenues and its impact on O&M expenditure in respective airports.

Further the factors which influence the ratio of Aeronautical and Non-Aeronautical expenditure and which differ from one airport to another airport have already been explained in proposal 6. Following are the additional factors that will be influence the ratio of Aeronautical and Non-Aeronautical expenditure:

- Non-Aero revenue potential as a whole or per passenger is different.
- Availability and extent of creation of facilities will increase non-aero revenue.
- Maintenance of facilities.
- Way of operating is also different.
- Revenue share to be paid to MoCA /Airport Authority of India.

Conclusion & Submission: As explained above, the ratio of O&M expenditure between aeronautical and non-aeronautical services is different and varying between various airports. In this scenario Authority's approach of arriving at the ratio of 80:20 on normative basis will be inconsistent with actual scenario. Therefore we request the Authority not to have a normative approach of arriving O&M expenditure between aeronautical and non-aeronautical services and rather to consider the basis of independent studies which Authority already initiated and to determine O&M expenditure individually for each airport.

Proposal No. 8. Regarding incentivizing airport operator to increase NAR and Truing up

a. *The Authority proposes to true up the NAR*
b. *The Authority proposes to incentivize (disincentivise) the airport operator only for his "efforts" (or lack of efforts) to increase (or fail to increase) the non-aeronautical revenues at the airport.*

c. *The Authority proposes to operationalize Proposal No. 8 (b) by taking half the difference between the growth rate of increase of NAR and the growth rate of passengers, calculated each year, with carrying costs calculated at the WACC as applicable and add the cumulative incentive (disincentive) amount to the ARR of the first year of the next control period (refer Paragraphs 11.1 to 11.6 above for reasons and framework) and particularly with reference to the example given in Table 12 to Table 16.*

d. *The Authority proposes to adopt the proposal of incentivisation from the next control period viz., 1st April, 2016 to 31st March, 2021 based on the results of growth in NAR and growth in Passengers as obtained in the Current Control period. Therefore the incentive amount will be added to the ARR of the FY 2016-17.*

e. *The Authority under this approach proposes to take into account the costs of generating the NAR and treat them as a pass-through.*

f. *The Authority also proposes that it may need to ring fence the airport assets for reasons mentioned in Para 10.11 read with Para 11.6 above.*

g. *The proposal of incentivisation of airport operators to increase non-aeronautical revenues will not apply to Delhi and Mumbai Airports (Refer paras 10.19 and 11.7 above).*

h. *In the case of CIAL, the Authority has issued a Consultation Paper proposing continuation of existing tariffs for the current control period. Hence, the question of any incentive pertaining to the current control period in respect of CIAL does not arise.*

BIAL Response:

BIAL would like to submit that it has appealed to AERAAT on the tariff order as issued by Authority and appeal is pending before tribunal for necessary hearings & adjudication. The major ground of the appeal is the regulatory till mechanism applied by AERA in tariff determination which in effect resulting into Single till methodology

of determining tariff.

Hence BIAL urges Authority to await, before going ahead with applying the above proposal as may get determined through consultation, for the final outcome of the appeal and consider the issues as gets determined by AERAAT tribunal in its final judgment.

Subject to the final outcome of above appeal, BIAL would like to highlight below certain observations on Authority's proposal for consideration at their end:

- AERA assumes that growth of Non Aeronautical Revenues (NAR) will always be more than that of growth of passenger traffic due to increased propensity to purchase and increased penetration. However this assumption, over long term, may not hold good as the trend of certain NAR revenues per passenger witnessing a trend of falling at airports worldwide.
- The performance of country's economy plays a vital role in the growth of certain NAR revenues such as Advertisement, Car parking revenue etc. Indian economy is subject to more fluctuations, as compared to steady performance of developed countries, which will get reflected in the performance of above NAR revenues and hence NAR growth may not always be more than traffic growth.
- Proposed framework of incentivisation considers rewarding the respective airport operator for increase in growth of NAR as against increase in the traffic growth. Such an approach may result into differential treatment between airports that has already achieved significant growth on NAR as compared to airports with low performance.
- BIAL submits that there should be proper definition of NAR and presently there is inconsistency in the treatment of NAR by Authority in the tariff determination of among various airports. The provisions of Concession agreement regarding treatment of NAR has to be considered by Authority while

determining tariffs of respective airports.

- Ring fencing of airport activities as proposed by Authority has clear benefits. However Authority has to consider existing project & land lease agreements which has clear definition of Airport & Non Airport activities and to avoid differential interpretation of provisions of agreements.

Conclusion & Submission: BIAL submits to AERA that an appeal to AERAAT on the tariff order is pending for necessary hearings & adjudication. The major ground of the appeal is the regulatory till mechanism applied by AERA in tariff determination which in effect resulting into Single till methodology of determining tariff.

Hence BIAL urges Authority to await, before going ahead with applying the above proposal as may get determined through consultation, for the final outcome of the appeal and consider the issues, while going ahead with above proposal, as gets determined by AERAAT tribunal in its final judgment.

Airport Benchmarking Study & Developing Guidelines for Terminal/Airfield Development Works

Final Report

November 2014

Kempegowda
INTERNATIONAL
AIRPORT
BENGALURU

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Executive Summary

EXECUTIVE SUMMARY

A. Introduction

1. The Airports Economic Regulatory Authority (AERA), established in May 2009, is a statutory body. The main functions of the Authority are to determine airport-related tariffs and to monitor the set performance standards.

2. AERA in its Consultation Paper No. 5/2014-15, made eight proposals in relation to the determination of airport tariffs. Of the proposals made by AERA, Proposal No. 5 – 'Norms of Capital Costs' is relevant for this report. The aspects mentioned by AERA under Proposal No. 5 are as follows:

    a. The Authority expects that while finalizing the scope of future capital works, the Airport Operator would abide by the indicated norms:
        i. IMG Norms for Terminal Building; and
        ii. Design criteria for Runway/Taxiway/Apron (Airside works) as may be available in published literature on the subject (ICAO Documents, DGCA CARs as may be applicable).

    b. The Authority proposes to consider capital costs of Terminal buildings at a ceiling cost of INR 65,000 per sqm or actual whichever is lower.

    c. The Authority proposes to consider capital costs of Runway/Taxiway/Apron at a ceiling cost of INR 7,000 per sqm or actual whichever is lower (excluding earthworks up to sub-grade level). The expenditure of the earthworks will be carried out as per the CPWD methodology.

    d. The Authority proposes to consider capital costs of other works based on a publically available standard like CPWD methodology, (for scheduled items CPWD schedule of rates and for market items, proper market rate analysis in line with CPWD framework and methodology).

3. Pursuant to the AERA notification, Bangalore International Airport Limited (BIAL), the operator of Kempegowda International Airport, Bengaluru, appointed AECOM to undertake an 'Airport Benchmarking Study and Developing Guidelines for Terminal/Airfield Development Works'.

B. Approach and Methodology

1. The approach for the study has been to select comparable Indian airports for benchmarking with Kempegowda International Airport, Bengaluru. The selection is primarily driven by airports having similar volumes of traffic and where new terminal facilities have been recently constructed or are under-development.

2. The benchmarking exercise of selected airports has been undertaken by comparing the following parameters:

i. Size of new terminals;
ii. Cost of construction;
iii. Quality of construction; and
iv. Service levels as per the ACI ASQ survey.

3. Prior to embarking on the development of guidelines aspects of this study we have reviewed Cochin Airport as a Case Study to examine whether it is a suitable airport to for the establishment of benchmarking norms to be applied to other Indian airports.

4. For the development of guidelines for terminal area norms, we have reviewed the available documentation on the Inter-Ministerial Group (IMG) recommendation of 25 sqm per Peak Hour Passenger (PHP) for integrated terminals. We have assessed whether or not there has been a scientific approach in arriving at the 25 sqm figure and if various factors which contribute to the overall size of a passenger terminal have been considered. Further, we have reviewed internationally recognized norms and the methodology for calculating passenger terminal areas as laid down by the International Air Transport Association (IATA) in the Airport Development Reference Manual (ADRM) as this is a globally accepted methodology for terminal sizing with a scientific basis and a clearly defined methodology.

5. For the development of guidelines for terminal cost norms, we have reviewed development costs for new terminal facilities and compared these with comparable costs calculated based on CPWD methodology. The costs incurred for various terminal buildings and the parameters governing such conditions have been reviewed in detail to ascertain if the ceiling cost of INR 65,000 per sqm is reasonable and whether this norm should be adopted under all conditions of operations. Further, various factors affecting the terminal building costs have also been examined. We have compared terminal cost for benchmarked airports on two different parameters - designed passenger capacities and areas provisioned. Cost per sqm relates to comparison of actual size and quality of facility constructed, whereas, the cost per annual passenger capacity relates to comparison on account of facility's productivity and efficiency. ICAO also uses productivity/efficiency as a key 'Performance Indicator' for airports performance. As per ICAO, cost effectiveness refers to the financial input or costs required to produce a non-financial output i.e. total cost per passengers.

6. Factors affecting the pavement costs have been examined in detail and the findings have been noted.

7. AECOM has consolidated documentation from information provided by BIAL, extracted from AERA's consultation papers, sourced from libraries, Airports Council International (ACI), airports and regulator's websites, industry sources, visit to airports and AECOM's own involvement with airport development.

C. Selection of Indian Airports and Benchmarking with Kempegowda International Airport

1. No airport is identical to another airport in terms of the market that it serves and hence the infrastructure that it provides. Different airports also operate with different business strategies and priorities, serve different customer bases (both airlines and passengers) and adopt different target levels of service (and for PPP airports these target levels of service are defined within the concession agreements).

2. Airport terminals are highly complex pieces of infrastructure and their configurations and layouts not only respond to the target markets and proposed levels of service but also reflect local constraints and challenges.

3. The airports selected for benchmarking with Kempegowda International Airport (upgraded Terminal-1) are as follows:

    i. Indira Gandhi International Airport, Delhi (Terminal-3);
    ii. Chhatrapati Shivaji International Airport, Mumbai (Terminal-2);
    iii. Netaji Subhash Chandra Bose International Airport, Kolkata (new integrated terminal);
    iv. Chennai International Airport, Chennai (new domestic and international terminals); and
    v. Cochin International Airport, Cochin (upgraded domestic and new international terminals).

4. Domestic passenger traffic at Chennai, Delhi and Mumbai Airports is between 65-68% whereas, at Bangalore and Kolkata Airports, is around 80%. In the case of Cochin Airport, domestic traffic (40%) is less than international traffic.

5. The Kolkata, Delhi, Mumbai and Bangalore Airport terminals are integrated terminals, whereas Chennai and Cochin Airport terminals are non-integrated.

6. Chennai Airport:

    i. Being AAI owned, Chennai Airport is not governed by any concession agreement requirements. The PPP airports (Delhi, Mumbai and Bangalore) operate with concession agreements that include clearly defined service standards. Performance against the defined services standards is measured and financial penalties are imposed for poor performance.

    ii. Annual traffic (12 months to end March 2014) is 12.90 million comprising of 65% domestic and 35% international.

    iii. Domestic and international operations are from separate buildings (non-integrated terminals).

    iv. The cost per sqm of development at Chennai Airport is lower than that at Bangalore, however, on a cost per mppa basis, it is similar to Bangalore.

    v. The quality of construction at the new Chennai terminals is subjectively assessed as average when compared with Delhi, Mumbai and Bangalore Airports.

    vi. Service levels achieved are generally lower than other benchmarked airports on most of the service quality parameters, except for Cochin Airport.

7. Kolkata Airport:

    i. As an AAI owned and operated airport, Kolkata Airport is not governed by any concession agreement requirements.

ii. Annual Passenger traffic (12 months to end March 2014) of 10.10 million comprising 83% domestic (higher than other benchmarked airports) and 17% international.

iii. Kolkata's new terminal houses both International and Domestic operations under one roof. The terminal is designed for independent peaks of Domestic and International traffic even though these peaks occur at different hours of the day. However, the terminal is considered to be an integrated terminal. If the PHP was calculated as a truly integrated facility i.e. using a coincident and combined domestic and international flow the peak passenger volume would be less than the sum of the separate and non-coincident domestic and international peak hour passenger flows resulting in a higher PHP per sqm value than the suggested 25sqm/php norm.

iv. The cost of construction of the new terminal at Kolkata Airport is around 17% lower than the cost per sqm recorded for the Bangalore Airport terminal. This is likely to be related to Kolkata's new terminal site being green-field, as compared to Bangalore which was upgraded around a live existing terminal operation.

v. Using the capital cost per mppa benchmark, the Kolkata terminal cost is noted to be more than that at Bangalore, suggesting that the Kolkata terminal is less efficiently utilized than Bangalore T-1 i.e. Bangalore Airport T-1 processes more annual passengers for each 1 million INR spent on terminal construction.

vi. The quality of construction observed at Kolkata Airport's new terminal is subjectively assessed as average when compared to that observed at the Delhi, Mumbai and Bangalore Airport terminals.

vii. The service levels achieved at Kolkata Airport, although higher than those at Chennai Airport, are lower than the service levels recorded at Delhi, Mumbai and Bangalore Airports on most of the measured service quality parameters.

8. Cochin Airport:

i. The airport operator is not bound by any concession agreement or AAI standards/norms, and therefore the airport operator has a high degree of freedom in its planning and operational activities.

ii. The new international terminal is designed for a relatively high area per PHP (38sqm) and the domestic terminal is designed for a relatively low area per PHP (12sqm), as compared to the IMG norm.

iii. The new international terminal development cost per mppa is higher than that at Bangalore T-1 or Chennai Terminal as the Cochin area per PHP is 38sqm and utilization of the terminal for International passengers is limited to only certain hours of the typical operational day.

iv. The quality of construction observed was assessed as very basic and reflects the low cost model adopted by the airport operator.

v. Whilst Cochin Airport does not participate in the official ACI ASQ survey it does undertake its own customer service surveys using an ACI-accredited market research company. The reports published by the Cochin Airport reveal a significantly lower overall satisfaction rating as compared to other benchmarked airports.

9. Bangalore Airport:

i. Being a PPP airport, Bangalore Airport is governed by a concession agreement requiring compliance with specified service levels.

ii. At Bangalore Airport T-1, development constraints, such as limitations on lateral expansion and a single level kerb side etc. are noted resulting in a relatively low figure for sqm per PHP. This Bangalore Airport sqm per PHP value should not be construed as an acceptable standard for area norms benchmarking.

iii. The cost per sqm of the terminal development at Bangalore Airport is higher than that at Chennai and Kolkata Airports. However, considering the better facility provision at Bangalore than at Kolkata/Chennai Airports (higher ASQ ratings and superior quality of construction), the Bangalore Airport cost does not seem to be excessive. Furthermore, the lower cost per mppa at Bangalore Airport compared to that at Kolkata Airport indicates better utilization of the terminal building assets at Bangalore Airport.

iv. It is also noted that the cost of the Bangalore Airport terminal development would have been affected by factors such as the concession agreement requirement to meet high performance standards and limitations of development at the brown-field terminal site etc.

v. Bangalore Airport T-1 is a modern and efficient terminal with a cost of INR 1,075 million per mppa. Bangalore Airport T-1 is more productive and cost effective on a cost per mppa basis when compared to the AAI airports and Cochin Airport.

vi. The quality of construction observed at Bangalore Airport is superior to that observed at Chennai, Kolkata and Cochin Airports.

vii. The ASQ ratings for Bangalore Airport are observed to be higher than those at the AAI airports (Chennai and Kolkata Airports) and much higher than the overall ASQ score recorded at Cochin Airport.

D. Cochin International Airport – Case Study

1. Our analysis of Cochin Airport on a variety of different parameters indicates the following:

i. The target customer segment and relative positioning of Cochin Airport is different from the other benchmark airports that have been compared in this study.

ii. The existing passenger terminals at Cochin Airport are low cost terminals where the passenger service quality is relatively basic, as compared to other larger terminals across India.

iii. Cochin Airport is not governed by a concession agreement or the need to meet AAI defined service standards. This provides the airport operator with a high degree of freedom and flexibility in the planning and operation of the airport.

iv. Benchmarked airports such as Delhi, Mumbai and Bangalore, being signatories to concession agreements, have to maintain high performance standards.

v. The cost of development, as set out in AERA's normative approach consultation paper, of the new international terminal at Cochin Airport is for the complete structure required for the year 2028. However, the fit-outs are being provided for the extent of the terminal that is required for 2021 only. As a result, the total finished cost of the complete facility (including the fit-outs required to 2028) will increase from the current projected cost of INR 6,500 million. In such a scenario, comparison of the Cochin Airport cost of INR 6,500 million with other benchmark airports (with fully fitted-out facilities) would not be appropriate.

vi. The Cochin Airport authority markets the airport as a pioneer in developing a low-cost, functional airport[1]. And whilst there is nothing wrong with that, as it serves a particular market, translating that model to other larger airports in India may not be appropriate.

2. Considering all the above factors, we conclude that Cochin Airport should not be used as a suitable benchmark airport in the setting of norms for larger airports in India.

E. Guidelines for Terminal Area Norms

1. AERA has suggested that integrated terminals in India should be constructed using the IMG norm of 25 sqm per PHP. It is understood that this norm originated from AAI, although there does not seem to be any background analysis available on how this norm was derived, and therefore how it should be applied.

2. The IMG report was prepared in September 2008 and revised in January 2009 and does not consider the following factors which are pertinent for terminal sizing:

i. Geographical location, terrain and availability of land;
ii. Configuration of terminal layout;
iii. Type of terminal – single, one and half or two level;
iv. Structural requirements;
v. Operator being a signatory to concession agreements;
vi. Requirement for enhanced operational and security requirements; and
vii. Competitive positioning of the airport in the region etc.

3. It is clear from the IMG report that the norm of 25sqm per PHP is based on AAI's suggestion. However, it is noted that AAI had itself undertaken construction of integrated terminals (for example, Amritsar[2] which was commissioned in February 2009) at a size of 40,175 sqm for a peak hour passenger capacity of 1,200, resulting in 33sqm per PHP.

[1] Presentation dated 17 June 2014 by Cochin International Airport to AERA during stakeholders meeting
[2] GoI Press Release on 25th February 2009 (http://pib.nic.in/newsite/erelease.aspx?relid=47938)

4. As mentioned earlier, Bangalore, Delhi and Mumbai Airports are governed by concession agreements which direct performance standards. For example, if there is a requirement to ensure that 95% of passengers wait no longer than 5 minutes at security search, then enough space needs to be provided for the requisite number of X Ray machines to ensure that this standard can be met.

   Chennai, Kolkata and Cochin Airports on the other hand, do not have any such concession agreement requirement, resulting in more flexibility in the amount of space that is provided.

   For example:

   i. Cochin Airport plans 12sqm per PHP for its domestic terminal – the current service level for 'overall satisfaction' is 3.70 compared to an average of 4.42 for the other benchmarked airports. The quality of construction observed is basic – below average.

   ii. Kolkata Airport calculates its PHP independently for domestic and international operations. A high PHP is reported based on the summation of the individual domestic and international peaks therefore assuming coincidence of peaks. This is unlikely to be the case in practice as domestic and international peaks at Indian Airport rarely occur at the same time. At Kolkata Airport this results in the need to plan a larger terminal building than would otherwise be the case if some of the domestic and international facilities (check-in desks for example) were used on a flexible/shared basis .

5. The average terminal area actually constructed for integrated terminal facilities in India is in the range of 25-59 sqm per PHP.

6. IATA is an internationally recognized body which also lays down standards for terminal sizing based on service standards and local processing times. The approach recommended by IATA is bottom-up requiring a specific area calculation for each processing facility.

7. IATA in its Airport Development Reference Manual 9th and 10th edition does not quote any specific area yardstick for integrated terminals. However, ADRM9 does suggest that "Experience has shown that, when designing facilities for purely domestic or charter passengers, the corresponding maximum sqm/PHP figure should not exceed 25 sqm and 30 sqm respectively." ADRM10 suggests that for international terminals the area per PHP should be 35 sqm.

8. In addition to the 'top-down' area per PHP yardsticks, IATA also provides a 'bottom-up' approach to the calculation of terminal areas based on forecast passenger flows, local service standards and locally observed facility processing rates, Adoption of the IATA ADRM bottom-up approach for terminal planning provides the necessary flexibility to meet local conditions as well as any mandatory service standards set out in concession agreements in the planning of terminal buildings.

9. It is noted that each airport by virtue of the traffic handled, airlines serving the airport, route connections, position of the dominant carrier, location advantages etc. has the potential to become a hub airport. This competitive positioning is generally recognized as very strategic for the future overall development of the airport, region and the country.

Accordingly, such aspects should be considered when terminal development is planned (including sizing).

10. In conclusion, IMG norms should not be used as a planning tool because the terminal planning process is much more complex requiring calculation of space based on local processing rates and pre-defined service standards etc.

F. Guidelines for Terminal Cost Norms

1. Airport facilities can reasonably vary in specification and price for a number of compelling reasons including traffic type, degree of peaking, facility specifications, the needs of users, and local costs and conditions etc. There is a wide range of such issues influencing the cost of airport terminals, most of which may account for legitimate differences between the costs of airport passenger terminals across India. It appears that AERA may not have accounted for all these factors while fixing the cost norm of INR 65,000 per sqm.

2. As development costs vary due to the timing of construction, physical location, customer base and other factors, as discussed in this report, there is no conclusive methodology to compare airport terminal costs on per sqm basis.

3. Evaluation of Terminal costs to its throughput in annual passengers evidently gives an indication of the cost effectiveness and utilization of the terminal. This commensurate with the tariff determination process as it considers *annual passenger throughput* for determining the applicable development fee. ICAO also uses productivity/efficiency as a key 'Performance Indicator' for airports performance. As per ICAO, cost effectiveness refers to the financial input or costs required to produce a non-financial output i.e. total cost per passengers. AERA should thus also evaluate airports for their productivity and cost effectiveness and incentivize efficiency.

4. The indexed construction costs expended for all the recently developed major airports in India show that construction cost varies from location to location and from trade to trade due to various local factors. The assessed costs lie in the range of INR 112,000 – 148,000 per sqm, significantly above the suggested INR 65,000 per sqm benchmark norm.

5. We have further attempted to estimate the broad costs for construction of a terminal building based on CPWD methodology (base parameters that the construction industry references across the country). On the basis of our calculation, we note that the cost for an airport terminal building, including other airport system related costs, is in excess of INR 149,000 per sqm and the cost of INR 65,000 per sqm, as recommended by AERA, is not feasible once all the necessary infrastructure and systems required for a large and complex airport terminal are taken into account.

6. Furthermore, the cost of construction of a terminal, to a large extent, is based on the planning and design of the terminal. So, unless the planning and design norms and specifications that are followed for the works and the various airport systems of constructed terminals are compared and understood in the context of each of their specific physical and functional requirements, just comparing a high level cost per sqm does not help in understanding the reasons for variances in the costs of terminals. Costs are clearly a function of the required performance levels and also the complexity of the infrastructure which will vary from airport to airport.

7. Therefore, any 'one-size fits all' approach is not appropriate for Terminal Building costs. Larger terminals often require more complex facilities leading to higher CAPEX. A range of other factors mean that what is cost effective at one terminal may not be at another.

G. Guidelines for Airfield Pavement Cost Norms

1. The design of airport pavements is a complex engineering problem that involves a large number of interacting variables. Many of these variables will differ from airport to airport and cannot be fixed at a particular value for design purposes.

2. Previously it was typical in pavement design for only the heaviest aircraft to be identified as the critical aircraft for design purposes. However, now in the FAARFIELD design procedure all anticipated aircraft in the traffic mix are included in the design assessment and the Cumulative Damage Factor (CDF) of each aircraft is determined. CDF replaces the need to adopt the design aircraft procedure and the FAARFIELD process through the CDF indicates the Most Demanding Airplane (MDA).

3. Aircraft information (all anticipated aircraft in the traffic mix, aircraft weight, gear configuration, annual departures and annual growth) will have a substantial impact on the design thickness of the pavement and it is very likely that these input parameters will differ from airport to airport i.e. the cost per sqm of a Code 4C runway at a regional airport is likely to be very different to that of a Code 4F runway at a major international airport.

4. Similarly, sub-grade strength will vary from airport to airport and this will also have major effect on the required pavement thickness. Furthermore, pavement construction at an operational airport is likely to be less efficient and therefore more costly than pavement construction at a green-field airport.

5. In view of these various parameters significantly affecting the design and construction, and therefore costs of airfield pavements, a ceiling rate for airfield pavements would not be suitable to fit all scenarios at all locations.

H. Conclusions

1. Terminal Area Norms:

    a. There should be no 'one size fits all' policy for airport terminals in India because, when operational terminals are benchmarked against each other it is clear that very few comparisons can be made; they are all different because they have different goals, ambitions and aspirations and different markets to serve. IMG norms should not be used as a planning tool.

    b. IATA ADRM is the International Standard Methodology based on a clear and scientific 'bottom-up' approach which allows local traffic, operational and service characteristics to be taken into account to provide the facilities and space required to meet a particular target Level of Service. It is a methodology recognized and supported by the airports' key customers – the airlines and as such is likely to receive support from these key airport stakeholders.

2. Terminal Cost Norms:

    a. There are a wide range of issues influencing the cost of airport terminals, and it appears that AERA may not have accounted for all these factors while fixing the cost norm of INR 65,000 per sqm.

    b. The development cost of existing terminal facilities is in the range of INR 112,000 – 148,000 per sqm, which is significantly above AERA's suggested norm, and clearly indicates that a 'one-size fits all' approach is not appropriate for Terminal Building costs.

    c. Broad costs for the construction of a terminal building based on the CPWD methodology indicate a cost of approximately INR 149,000 per sqm, corroborating our view that the cost norm of INR 65,000 per sqm, as recommended by AERA, is not feasible.

    d. Our analysis indicates that the cost of terminal buildings in India on a per sqm basis varies greatly because the airports have different operational concepts, serve different markets and have been built to different building specifications. This variability in building form and function is a natural consequence of the airport operators reflecting variability in the passenger market and in passenger expectations at different airports. It also reflects variability in local construction market conditions and in building costs. Given this significant variability it is not particularly meaningful to compare airport terminal costs on a sqm basis without an understanding of the building specifications and all of the various elements that go to make up the total cost. Even with this understanding in place the cost/sqm measure is effectively comparing 'apples with oranges' because no two terminals have exactly the same function or exactly the same specification. We therefore conclude that adoption of a simple and coarse top-down cost/sqm norm for passenger terminal building costs is not particularly helpful.

    e. The cost measure should ideally also compare airports in terms of their productivity, e.g. their cost per passenger throughput unit such as mppa. This is also commensurate with the tariff determination process as it considers *annual passenger throughput* for determining the applicable development fee. ICAO also, by its cost effectiveness measure, emphasizes on terminal cost productivity considering *annual passenger throughput* criteria.

3. Pavement Cost Norms:

    a. Various parameters significantly affect the design and construction of airfield pavements. Defining a ceiling rate for airfield pavements would not be suitable to fit all scenarios.

Section 1

Introduction

1. INTRODUCTION

The Airports Economic Regulatory Authority (AERA), established in May 2009, is a statutory body. The main functions of the Authority are to determine airport related tariffs and monitor the set performance standards.

AERA in its Consultation Paper Addendum No. 22/2013-14 dated 24th January 2014, has indicated that:

> *"wherever new investments are proposed for example in respect of BIAL, there was a necessity for stakeholders consultation, appropriate preparation of detailed engineering and cost estimates based on publically available schedule of rates like CPWD and that terminal area should conform to the norm laid down in the Report of the Inter-Ministerial Group – Norms and Standards for Capacity of Airport Terminals."*

In their Consultation Paper No. 5/2014-15 – 'In the matter of Normative Approach to Building Blocks in Economic Regulation of Major Airports', issued on 12th June 2014, AERA reviewed the investments made by the airport operators and disallowed certain elements of the capital costs. AERA had also come across comments from stakeholders suggesting that the investments in airport facilities (Delhi and Mumbai Airports) have been of a large magnitude.

AERA in their above Consultation Paper No. 5/2014-15, made eight proposals (refer to Annexure A) in relation to the determination of airport tariffs. Of the proposals made by AERA, Proposal No. 5 – 'Norms of Capital Costs' is relevant for this report.

The aspects mentioned by AERA under Proposal No. 5 are:

a. The Authority expects that while finalizing the scope of the future capital works, the Airport Operator would abide by the indicated norms.

   iii. IMG Norms for Terminal Building; and

   iv. Design criteria for Runway/Taxiway/Apron (Airside works) as may be available in published literature on the subject (ICAO Documents, DGCA CARs as may be applicable).

b. The Authority proposes to consider capital costs of Terminal building at a ceiling cost of INR 65,000 per sqm or actual whichever is lower.

c. The Authority proposes to consider capital costs of Runway/Taxiway/Apron at a ceiling cost of INR 7,000 per sqm or actual whichever is lower (excluding earthwork up to sub-grade level). The expenditure of the earthwork will be carried out as per the CPWD methodology.

d. The Authority proposes to consider capital costs of other works based on a publically available standard like CPWD methodology, (for scheduled items CPWD schedule of rates and for market items, propose market rate analysis in line with CPWD framework and methodology).

The framework and philosophy for tariff determination decided for adoption by AERA has been challenged by the private airport operators in the appellate tribunal AERAAT. After discussions, the Ministry of Civil Aviation (MoCA) indicated that AERA gives consideration to developing norms so that all stakeholders are aware of the boundaries within which they have to operate.

Pursuant to the AERA notification, Bangalore International Airport Limited (BIAL), the operator of Kempegowda International Airport, Bengaluru (KIA), appointed AECOM to undertake an 'Airport Benchmarking Study and Developing Guidelines for Terminal/Airfield Development Works'.

As several factors contribute to the development of an airport facility, there is no standard facility whose services and infrastructure could be considered typical. Benchmarking is therefore a complex exercise. Variations could occur due to direct investment by the airport operator, passenger volumes, capacity constraints, mix of international and domestic traffic, daily and seasonal peakiness, geographical locations etc.

AECOM recognizes the complexities related to benchmarking and has structured this report as follows:

- Section 1: Introduction to the report
- Section 2: Brief profile of Kempegowda International Airport, Bengaluru
- Section 3: Selection of Indian airports and Benchmarking vis-à-vis Kempegowda International Airport
- Section 4: Cochin International Airport – Case Study
- Section 5: Establish the range for terminal area and costs thereof
- Section 6: Establish the range for Runway/Taxiway/Apron and costs thereof

AECOM has consolidated documentation from information provided by BIAL, extracted from AERA's consultation papers, sourced from libraries, Airports Council International (ACI), airports and the regulator's websites, industry sources, visit to airports and AECOM's own involvement with airport development.

This document is prepared exclusively for the benefit and use of Bangalore International Airport Limited (BIAL, the Client) by AECOM India Private Limited (AECOM). This report, including the results contained herein is based upon information provided by BIAL and information available in the public domain. AECOM accepts no responsibility or liability for the consequence of this document being used for a purpose other than the purpose for which it was developed. Any person using or relying on this document for such other purposes agrees, and will by such use or reliance be taken to confirm his agreement to indemnify AECOM for all loss or damage resulting there from.

Section 2

Brief Profile on Kempegowda International Airport

2. KEMPEGOWDA INTERNATIONAL AIRPORT, BENGALURU

Artistic impression of terminal (T-1) at Bangalore (post upgrade)

In order to improve airport infrastructure in the country, the Government of India (GOI) envisaged Private Sector Participation in the airports sector. As an outcome of these efforts, India's first Green-field Airport project was set up at Devanhalli in Karnataka under a Public Private Partnership (PPP). The airport, having an area of approximately 4,000 acres, is located 30 km from Bangalore city, east of the Bangalore-Hyderabad National Highway No 7. Bangalore International Airport Limited (BIAL) commenced construction on Phase-1 of the project, having an annual handling capacity of 11.5 million passengers, in July 2005 and the airport was commissioned in May 2008.

Terminal-1 with an area of approximately 73,627 sqm (costing around INR 8,400 million) was provided with facilities to handle 2,733 peak hour passengers, expected in the year 2015 when annual traffic was forecasted to be 11.37 million. The passenger profile at Bangalore, being an IT hub, comprises largely of IT/ITES workforce which is attracted to the city from various parts of the world.

Terminal-1 at Bangalore airport (before upgrade)

With traffic touching 11.6 million in 2010-11, BIAL proceeded with the second phase of development in October 2010 to handle 20 million passengers. Providing additional areas, around 87,483 sqm, during development of phase-2 was based on feedback obtained from the public and the local IT community. Due to site constraints and keeping in mind future master planned development, the extension was limited to a lateral extension of an operational facility.

With enhanced capacity, the enlarged integrated terminal (Terminal-1) was commissioned on 14th December 2013 at a cost of INR 11,055 million, and Bangalore International Airport was renamed as Kempegowda International Airport. Keeping in view the future requirements of traffic, one code F stand to accommodate new large aircraft such as the A380 has been provided. The integrated terminal has 26 boarding gates and 15 aerobridges.

Airside view of upgraded T-1

Landscaped approach road at Bangalore airport

Commensurate with the local 'Garden City' theme, the airport has been designed with over 100 acres of external landscaped greens which brings out the character of the city.

The long term development plan provides for the construction of a future Terminal-2 (T-2) with a capacity to handle 35 MPPA. Phase-1 of the T-2 development is proposed to be operational by 2016 and will have an annual handling capacity of 20 mppa. The combined passenger handling capacity of T-1 and T-2 would be 55 mppa. The construction of a 2nd parallel runway within the existing land area is envisaged. The resultant annual service volume with two operational runways would be around 400,000 aircraft movements.

Artistic impression of proposed terminal (T-2) at Bangalore Airport

A brief profile of the airport is given in Table 1 below:

Table 1: Kempegowda International Airport Profile

Kempegowda International Airport, Bengaluru	
Airport Data	
IATA Airport Code	BLR
Total Airport Area (Acres)	4,008
Existing Airport Capacity (mppa)	20
Annual Passenger Traffic (YTD 31st March 2014)	1,28,68,830
Annual ATM Traffic (YTD 31st March 2014)	1,17,728
Terminal Data (Upgraded Terminal-1)	
Type of processing	Integrated
Terminal Floor Area (Sqm)	1,61,110
Annual Terminal Passenger Capacity (mppa)	20.0
Terminal Floor Area/Design mppa	8,056
Terminal Design Peak Hour passengers (PHP)	6,540
Terminal Floor Area/PHP	25
Cost Data (Upgraded Terminal-1)	
Total Actual cost (in million INR)	19,455
Total Indexed cost (in million INR)	21,495
Indexed cost per mppa (in million INR)	1,075
Indexed cost per sqm of GFA (in INR)	1,33,420

Note:
The total area and cost of upgraded Terminal-1 considered (as per BIAL submission) is as below:

Particulars	Floor Area in Sqm	Amount (INR Million)
T-1 Phase 1	73,627	8,400
T-1 Phase 2 - Expansion Project	87,483	11,055
Total construction cost - T1 Phases 1 + 2	1,61,110	19,455

The total cost of completion of Terminal-1 (Phase 1 + Phase 2) has been indexed to a current cost base (June 2014) by applying the necessary cost indices as published by The Construction Industry Development Council. (Refer to Table 10 for the indexed cost).

Source: The above data has been sourced from the websites of AERA and the respective airport operator and from details available in public domain. Traffic data has been sourced from the AAI website.

Section 3

Selection of Indian Airports and Benchmarking vis-a-vis Kempegowda International Airport

3 SELECTION OF INDIAN AIRPORTS AND BENCHMARKING VIS-A-VIS KEMPEGOWDA INTERNATIONAL AIRPORT

3.1 Selection of Indian Airports For Benchmarking

AERA in its Consultation Paper No. 5/2014-15 has indicated that, on account of comparability issues, Indian airports should not be compared with foreign airports. Hence, foreign airports are not benchmarked in this exercise.

In India, of the total 132 operational airports, 19 airports[3] are classified as International airports by MoCA, out of which 14 international airports qualify as 'Major Airports'[4].

The characteristics of the 14 Major Airports are broadly classified under the following heads and summarized in Table 2 below:

- Annual Passenger Traffic;
- Mode of Development; and
- Major upgrade of facilities in the last 5 years to enhance passenger capacities.

Table 2: Parameters Considered for the Selection of Benchmark Airports

Major Airports	Annual Passenger Traffic (million)		Mode of Development		Major Upgrade
	>5 million	<5 million	PPP	AAI/Others	During last 5 years
Delhi	25-40		✓		T-3
Mumbai	25-40		✓		T-2
Chennai	5 – 15			✓	New Terminal
Bangalore	5 – 15		✓		Expansion of T-1
Kolkata	5 – 15			✓	New Terminal
Hyderabad	5 – 15		✓		-
Cochin	5 – 15			✓	Under development
Ahmedabad		1.5 – 5		✓	New Terminal
Goa		1.5 – 5		✓	New Terminal
Trivandrum		1.5 – 5		✓	New Terminal
Calicut		1.5 – 5		✓	-
Guwahati		1.5 – 5		✓	-
Srinagar		1.5 – 5		✓	New Terminal
Jaipur		1.5 – 5		✓	New Terminal

Note: Annual Passenger traffic is based on figures from AAI website for the year ending March 2014.

This study entails benchmarking of Bangalore Airport with other Indian airports. The selection of other Indian airports for benchmarking purposes is discussed below:

[3] Airports Authority of India website
[4] As per AERA, "Major Airport" means any airport which has, or is designated to have, annual passenger throughput in excess of one and half million or any other airport as the Central Government may, by notification, specify as such.

- Delhi and Mumbai Airports are the largest airports in India. Similar to Bangalore airport, these airports have also been developed / upgraded using the PPP model and have witnessed major upgrades recently. Despite Delhi and Mumbai Airports being very large in terms of passenger traffic, we have considered these airports in our study in order to benchmark the quality and development norms. AERA has also considered these airports in its consultation paper for the normative approach.

Delhi Airport Terminal-3

Mumbai Airport Terminal-2 Layout

- Chennai Airport has passenger traffic levels similar to Bangalore Airport. While Chennai Airport has witnessed a recent upgrade, as can be seen in the Master Plan in the figure below, the new terminals are not integrated and operate as separate dedicated terminals for international and domestic functions. AERA has also considered this airport in its consultation paper for the normative approach.

Layout of Chennai Airport after Facility Upgrade

- In terms of annual passenger traffic, Kolkata Airport is also considered for benchmarking. It has been recently upgraded including construction of a new integrated passenger terminal building (see figure below) for expansion of passenger capacity. AERA has also considered this airport in its consultation paper for the normative approach.

Layout of Kolkata Airport after Facility Upgrade

- Hyderabad Airport is a smaller airport than Bangalore (handling 67% of Bangalore traffic). Hyderabad airport is a PPP airport. However, no major facility upgrade has been undertaken during the last five years. Also, AERA in its consultation paper for the normative approach does not consider Hyderabad in its comparison. Hence, we have not considered Hyderabad Airport in our study.

- Cochin Airport is also a smaller airport (handling 42% of Bangalore traffic). The airport has just commenced work on a new international passenger terminal (non-integrated) and associated works. Cochin Airport, although smaller, even when compared to Hyderabad Airport, has been considered by AERA in its Consultation Paper for the normative approach along with larger airports such as Delhi, Mumbai, Chennai, Bangalore and Kolkata. The size of the proposed terminal development at Cochin Airport is similar to the size of the upgraded facility of Bangalore Airport, hence, Cochin Airport has been considered in this benchmarking analysis.

Existing Layout of Cochin Airport

Proposed International Terminal Building at Cochin Airport

Further, we have analyzed Cochin Airport as a Case Study in Section 4 of this report. The study focuses on aspects of development and operations of Cochin Airport to evaluate whether it is a valid comparator (with other airports being benchmarked) particularly for the setting of the norms considered by AERA.

- Other airports listed in Table 2 above have not been considered in this benchmarking exercise as they are not comparable to Bangalore Airport on any of the parameters discussed above.

In summary, airports at Delhi, Mumbai, Kolkata, Chennai and Cochin have been considered for benchmarking with Bangalore airport.

3.2 Scope and Approach for Benchmarking vis a vis Kempegowda International Airport

The scope for this section entails a benchmarking exercise for costs, quality of construction, passenger service levels and service quality at recently constructed/upgraded terminal buildings and associated functions for benchmarked airports considered vis-a-vis Kempegowda International Airport, Bengaluru.

The analysis under this section has been carried out for various benchmarking components at the following 6 airports:

- Kempegowda International Airport, Bengaluru;
- Indira Gandhi International Airport, Delhi;
- Chhatrapati Shivaji International Airport, Mumbai;
- Netaji Subhash Chandra Bose International Airport, Kolkata;
- Chennai International Airport, Chennai; and
- Cochin International Airport, Cochin.

At the commencement of this study a brief profile of each of the above airports has been developed to establish the size, scale of operations and other relevant technical and cost data/parameters.

Subsequently, each sub-element of the scope, as outlined above, has been examined using an appropriate methodology to establish the requirements for the analysis.

- Terminal construction cost analysis has been computed using the as-built construction costs, analysed and structured so as to ensure consistency of approach, categorization of costs and identification of the financial differences between the projects.

- For analysis of quality of construction, AECOM's experts have inspected the public and passenger processing areas at Delhi, Mumbai, Bangalore, Kolkata, Chennai and Cochin Airports to visually ascertain the quality of construction. The observations have been rated on a scale of 1 to 5, where 5 is superior and 1 is poor. The classification covers overall appearance, materials used, maintenance, life span etc. based on which an average score is calculated to establish a benchmark for comparison with Bangalore Airport. AECOM recognizes that benchmarking for quality of construction is subjective.

- The review of passenger service levels and service quality analysis has been based on the Airport Service Quality (ASQ) survey by Airports Council International (ACI). The ASQ Survey is the world's leading airport customer satisfaction benchmark programme with over 200 airports in more than 50 countries surveying their passengers every month of the year. All airports use the same questionnaire and follow the same survey methodology ensuring consistency in results and an ability to fairly and objectively compare airports. The programme offers quarterly results providing insight and comparisons with service performance of airports all over the world. The ASQ Survey is tailored for airports of all sizes, from 0.5 million passengers to 85 million.

  From the ASQ survey, performance measures are available for the levels of service delivered by an airport and the results obtained for an airport can be compared to the results obtained at other airports. The ASQ survey results provide a comparable analysis of the service performance actually delivered by the airport to be made.

  Our analysis of the ASQ survey data establishes Bangalore's performance as compared to the benchmarked airports. It also identifies reasons for Bangalore's performance and provides valid explanations and justifications for any 'under' or 'over' performance compared to the benchmarked airports.

- The analysis for security performance benchmarking has been based on the data analysis included in the ASQ airport customer satisfaction benchmark programme.

3.3 Sources of Data

For the purpose of this benchmarking, we have obtained data from the following sources:

- Extract of ASQ Survey data for the specific periods (Q3FY2013, Q4FY2013, Q1FY2014 and Q2FY2014) provided by BIAL. The ASQ data covers Delhi, Mumbai, Kolkata, Chennai and Bangalore Airports;

- Reports, Consultation Papers, Orders, Minutes of Stakeholder meetings, stakeholder presentations, etc. downloaded from AERA's website;
- Data for Indian airports obtained from websites of Airports Authority of India (AAI) and Director General of Civil Aviation (DGCA);
- Discussions with airport operators;
- Data for Mumbai and Bangalore Airports provided by MIAL/BIAL;
- Websites of individual airports; and
- Data for specific airports from industry sources.

Based on the data gathered, we have compiled the relevant information for the purpose of our analysis. However, due to some reluctance from various airport operators to share some required information, it has not been possible to obtain information for all of the parameters proposed to be evaluated.

At the end of this section, we have summarized the findings of our analysis for the benchmarking of Indian airports vis-a-vis Bangalore airport.

3.4 Profile of Benchmarked Airports

Indira Gandhi International Airport, Delhi

Google image of Delhi Airport

Delhi International Airport Limited (DIAL) was incorporated on 1st March 2006 with the objective of modernization and development of Delhi Airport. DIAL took over the operations of Delhi Airport in May 2006.

As the first step towards development, a saturation phase Master Plan was delivered in December 2006 which was developed to handle 112 million passengers forecasted for 2036.

Phase-I of the development comprised of 2 sub-phases as follows:

- Phase-IA covered the up-gradation of the existing domestic terminal (TIA), up-gradation of the existing international terminal (T-2) and construction of new runways and taxiways.

- Phase-IB primarily covered the construction of the new Integrated Passenger Terminal (T3) and associated aprons and a multi-level car parking.

The major components of development in Phase-I provided for:

- A new parallel runway 4,430m long;
- 5 parallel taxiways, 11 rapid exit taxiways; and
- An integrated passenger terminal having a floor area of 553,887 sqm for handling 34 million annual passengers and complying with the peak hour demand of 9450 passengers.

Artistic impression of terminal (T-3) at Delhi Airport

Salient features of the T-3 passenger terminal are:

- 8 level terminal building with a central processor and 2 connecting piers, each of 1200m length;
- 168 check-in counters;
- 92 travellators, 63 elevators, and 34 escalators;
- Multi-level car park for 4300 cars;
- 14 baggage reclaim belts;
- 41 in-line X-Ray machines; and
- 48 in-contact and 20 remote stands.

Check-in facility at T-3

Departure pier at T-3

The airport was dedicated to the nation on 3rd July 2010 and International services commenced on 28th July 2010. Domestic services of the major domestic carriers commenced in October 2010.

The existing total passenger handling capacity at IGIA is 63 million annual passengers which includes T-1C (9.37 million), T-1 D (8.15 million), T-2 (11.80 million) and T-3 (34 million).

A brief profile of the airport is given in Table 3 below:

Table 3: Indira Gandhi International Airport Profile

Indira Gandhi International Airport, Delhi	
Airport Data	
IATA Airport Code	DEL
Total Airport Area (Acres)	5,060
Existing Airport Capacity (mppa)	63
Annual Passenger Traffic (YTD 31st March 2014)	3,68,76,986
Annual ATM Traffic (YTD 31st March 2014)	2,90,772
Terminal Data (T-3)	
Type of processing	Integrated
Terminal Floor Area (Sqm)	5,53,887
Annual Terminal Passenger Capacity (mppa)	34
Terminal Floor Area/Design mppa	16,291
Terminal Design Peak Hour passengers (PHP)	9,450
Terminal Floor Area/PHP	59
Cost Data (T-3)	
Total Estimated cost (in million INR)	68,360
Total Indexed cost (in million INR)	82,117
Indexed cost per mppa (in million INR)	2,415
Indexed cost per sqm of GFA (in INR)	1,48,257

Note: The actual cost of completion of T-3 has been indexed to current costs (June 2014) by applying the necessary cost indices as published by The Construction Industry Development Council, (refer to Table 10 for the indexed cost).

Source: The above data has been sourced from the websites of AERA and the respective airport operator and details available in public domain. Traffic data has been sourced from the AAI website.

Chhatrapati Shivaji International Airport, Mumbai

Google image of Mumbai Airport

For the operation, maintenance, development, design, construction, upgradation, modernization, finance and management of Mumbai Airport, AAI entered into an Operation Maintenance and Development Agreement (OMDA) with Mumbai International Airport Limited (MIAL), a joint venture between the consortium GVK-SA and AAI.

The precincts of Mumbai Airport cover an area of approximately 1,967 acres.

Mumbai Airport has two cross runways. Due to their intersecting nature, simultaneous operations are not feasible. Therefore, effectively Mumbai is a single runway airport. Both runways have been upgraded and are Code F compliant with a full length parallel taxiway for the main runway and a partial parallel taxiway on the secondary runway. MIAL is in the process of upgrading the airfield infrastructure to provide parallel taxiways for the entire length on both sides of the runways.

There are two terminal buildings, geographically separated by the secondary runway. The recently constructed terminal (T-2) handles all international traffic whereas the original T-1 was modified a few years back and handles domestic traffic.

Artistic impression of T-2 at Mumbai Airport

T-2 has 4 levels of operational functions. All passengers enter the terminal at the fourth level into a large expanse of check-in facilities where 188 regular check-in and 20 Common User Self Service (CUSS) positions have been provided. 60 emigration check and 53 security check positions are located at this level. For rapid and efficient passenger movement to and from the boarding gates, 41 travellators, 47 escalators and 73 elevators have been installed. The international departures are located at the fourth level, whereas, domestic passengers proceed one level below to the third level for boarding the aircraft. Both international and domestic passengers pass through independent retail plazas spread over a total area of around 20,000 sqm. 52 departure gates have been provided in close proximity of the commercial outlets to maximize commercial opportunities.

Arrival passengers enter the terminal at the second level through channels dedicated for international and domestic passengers. A total of 10 fully automated baggage reclaim belts have been provided with the ability to use these for both international and domestic arrivals. For immigration clearance, 72 counters have been provided.

On the city-side area, a drop-off kerb has been provided to cater to passengers and visitors. A multi-level car park with 10 levels has been created across the kerb-side which can house 5,200 vehicles.

A brief profile of the airport is given in Table 4 below:

Table 4: Chhatrapati Shivaji International Airport Profile

Chatrapati Shivaji International Airport, Mumbai	
Airport Data	
IATA Airport Code	BOM
Total Airport Area (Acres)	1,967
Existing Airport Capacity (mppa)	50
Annual Passenger Traffic (YTD 31st March 2014)	3,22,21,395
Annual ATM Traffic (YTD 31st March 2014)	2,60,666
Terminal Data (T-2)	
Type of processing	Integrated
Terminal Floor Area (Sqm)	4,31,672
Annual Terminal Passenger Capacity (mppa)	40
Terminal Floor Area/Design mppa	10,792
Terminal Design Peak Hour passengers (PHP)	9,900
Terminal Floor Area/PHP	44
Cost Data (T-2)	
Total Estimated cost (in million INR)	54,000
Total Indexed cost (in million INR)	54,121
Indexed cost per mppa (in million INR)	1,353
Indexed cost per sqm of GFA (in INR)	1,25,374

Note: The estimated cost of completion of T-2 has been indexed to current costs (June 2014) by applying the necessary cost indices as published by The Construction Industry Development Council. Further, it is noted that the area under the current project cost scope is considered in the above analysis (refer to Table 10 for the indexed cost).

Source: The above data has been sourced from the websites of AERA and the respective airport operator and from details available in the public domain. Traffic data has been sourced from the AAI website.

Netaji Subash Chandra Bose International Airport, Kolkata

Layout of New Terminal Building at Kolkata

Of the 11 international airports managed by AAI, Kolkata Airport, which handled 10.10 million passengers for the year ending 31st March 2014, is ranked the second highest in India in terms of annual passenger volume. The total area of the airport is 1,670 acres. The present facilities consist of 2 parallel runways. Due to the limited separation, they cannot be operated simultaneously. Before the airport upgrade, there were 2 separate terminals for the processing of International and Domestic traffic. The total area of the terminals was 56,000 sqm (domestic - 26,000 sqm and international - 30,000 sqm). The combined handling capacity was approximately 5 million annual passengers (domestic - 4.06 million and international - 0.88 million). The actual traffic handled for the year ending 31st March 2014 was 8.34 million for domestic and 1.77 million for international operations.

In view of the continued growth in traffic and limited facilities at the existing international and domestic terminals, AAI undertook a large scale airport development plan at Kolkata Airport and a new integrated terminal was developed which was commissioned in August 2012.

City-side view of new Terminal Building at Kolkata

The new terminal with an area of 198,692 sqm (domestic - 119,741 sqm and international - 78,951 sqm) is a two level building and has an annual handling capacity of 20 million passengers (domestic - 16 million and international - 4 million). 23 additional aircraft stands, in addition to the existing 36 parking stands, have been created to meet the peak requirements for aircraft parking.

The old domestic terminal with a capacity of 4.06 million is proposed to be retained which would increase the total passenger handling capacity to 24.06 million annually.

A brief profile of the airport is given in Table 5 below:

Table 5: Netaji Subash Chandra Bose International Airport Profile

Netaji Subash Chandra Bose International Airport, Kolkata	
Airport Data	
IATA Airport Code	CCU
Total Airport Area (Acres)	1,670
Existing Airport Capacity (mppa)	24
Annual Passenger Traffic (YTD 31st March 2014)	1,01,00,232
Annual ATM Traffic (YTD 31st March 2014)	92,871
Terminal Data (New Integrated)	
Type of processing	Integrated
Terminal Floor Area (Sqm)	1,98,692
Annual Terminal Passenger Capacity (mppa)	20
Terminal Floor Area/Design mppa	9,935
Terminal Design Peak Hour passengers (PHP)	7,450
Terminal Floor Area/PHP	27
Cost Data (New Integrated)	
Total Estimated cost (in million INR)	21,546
Total Indexed cost (in million INR)	22,706
Indexed cost per mppa (in million INR)	1,135
Indexed cost per sqm of GFA (in INR)	1,14,280

Note: The actual cost of completion of the new integrated terminal has been indexed to current costs (June 2014) by applying the necessary cost indices as published by The Construction Industry Development Council, (refer to Table 10 for the indexed cost).

Source: The above data has been sourced from the websites of AERA and the respective airport operator and from details available in public domain. Traffic data has been sourced from the AAI website.

Chennai International Airport, Chennai

AAI is engaged in the development and operations of airports to provide high levels of service to support the growing requirements of the civil aviation industry. Currently, there are 127 airports under AAI's managerial responsibilities which include 14 international airports. Out of all the AAI airports, Chennai Airport handles the highest amount of passenger traffic and aircraft movements. During the year ending 31st March 2014, Chennai Airport handled 12.9 million passengers and 121,817 aircraft movements.

Airport facilities have been recently modified and provide capacity for the handling of 16 million annual domestic passengers and 7 million annual international passengers.

Domestic operations are processed through 2 separate buildings. The original terminal with an area of 19,000 sqm has the capability of processing 6 million annual passengers. The new domestic terminal with an area of 73,000 sqm can process an additional 10 million passengers. The overall facilities available at the domestic terminals provide for an area of approximately 92,000 sqm which can handle 16 million annual passengers, which corresponds to a handling capability of 5,360 peak hour domestic passengers. The processing facilities provided include 105 check-in counters and 8 arrival baggage conveyors.

The international facilities also operate through two buildings located side by side. The existing terminal with an area of 42,000 sqm has the capacity of handling 3 million passengers annually which corresponds to 2,150 peak hour passengers. The extension of 61,000 sqm to the international building provides for 52 additional check-in counters in addition to the existing 43. The number of baggage conveyor belts has also been increased from 4 to 7. To ensure quick clearance, 18 additional emigration and immigration facilities have been added, increasing the numbers to 34 and 38 respectively. With a total area of 103,000 sqm, the overall peak hour handling capability of international facilities is 4,450 passengers. In keeping with the trends at modern airports, a total of 18 aerobridges have been provided.

Chennai Airport has a main runway which can handle Code E aircraft. A secondary cross-wind runway is also available which is shorter and is proposed to be extended to cater for operations of Code D aircraft. The present runway capacity can handle 30 air traffic movements in an hour which is scheduled to be increased to 40 movements per hour. The apron provides 57 parking bays. 24 additional bays are being added which would increase the aircraft parking capacity to 81.

A brief profile of the airport is given in Table 6 below:

Table 6: Chennai International Airport Profile

Chennai International Airport, Chennai		
Airport Data		
IATA Airport Code		MAA
Total Airport Area (Acres)		1,283
Existing Airport Capacity (mppa)		23
Annual Passenger Traffic (YTD 31st March 2014)		1,28,96,055
Annual ATM Traffic (YTD 31st March 2014)		1,21,817
Terminal Data (New Terminals)		
Type of processing		Non - Integrated
	Domestic	International
Terminal Floor Area (Sqm)	72,614	60,528
Annual Terminal Passenger Capacity (mppa)	10	4
Terminal Floor Area/Design mppa	7,261	15,132
Terminal Design Peak Hour passengers (PHP)	3,300	2,300
Terminal Floor Area/PHP	22	26
Cost Data (New Terminals)		
Total Estimated cost (in million INR)		14,765
Total Indexed cost (in million INR)		14,974
Indexed cost per mppa (in million INR)		1,070
Indexed cost per sqm of GFA (in INR)		1,12,467

Note: The actual cost of completion of the new domestic and international terminals has been indexed to current costs (June 2014) by applying the necessary cost indices as published by The Construction Industry Development Council, (refer to Table 10 for the indexed cost).

Source: The above data has been sourced from the websites of AERA and the respective airport operator and from details available in public domain. Traffic data has been sourced from the AAI website.

Cochin International Airport, Kochi

Cochin Airport is located in the city of Kochi and is the busiest airport in the state of Kerala. It was the first airport in India to be built under PPP with equity participation from the airport users, general public, Non Resident Indians (NRI's), Government of Kerala and the airport service providers. The involvement of airport users was a pioneering concept of this project which was conceived even while a definite policy on private participation in airport infrastructure was not in place. Cochin Airport has a total area of 1,300 acres.

Construction of the existing terminal commenced in August 1994 and operations started from June 1999. Cochin Airport is generally regarded as a low cost model of airport capable of providing functionally efficient services. During the year ending 31st March 2014 the airport handled 5.38 million passengers. Approximately 61% of the total traffic was international and domestic traffic constituted the remaining 39%. The domestic and international ATMs were 22,893 and 23,136 respectively.

Cochin Airport presently operates two separate terminals for domestic and international passengers. The domestic terminal was developed in 1999 and is operating beyond its maximum passenger handling capacity, which has resulted in congestion during peak hours. The existing international terminal has a peak hour handling capacity of 2,400, whereas the current throughput is less than 2,400.

As per the new expansion plan, the international terminal is to be converted completely into a domestic terminal, while a new international terminal of 150,000 sqm is to be built on the eastern side of the existing structure having segregated arrivals and departures at different levels.

Proposed New International Terminal

The international passenger terminal building is planned to have 112 check-in counters with in-line baggage handling facilities, 100 immigration counters and total area of 3,000 sqm earmarked for duty-free shops at the arrival and departure levels, 19 boarding gates, 15 aero bridges and 6 baggage conveyor belts.

The total area of 150,000 sqm is planned to be constructed in phase-1 itself, however, the facilities such as check-in counters, baggage conveyor belts, aerobridges etc. will be installed in phases. The two-level terminal is expected to be ready by 2016.

A brief profile of the airport is given in Table 7 below:

Table 7: Cochin International Airport Profile

Cochin International Airport, Cochin		
Airport Data		
IATA Airport Code		COK
Total Airport Area (Acres)		1,300
Existing Airport Capacity (mppa)		15
Annual Passenger Traffic (YTD 31st March 2014)		53,83,114
Annual ATM Traffic (YTD 31st March 2014)		46,029
Terminal Data (New International & Upgraded Domestic)		
Type of processing		Non - Integrated
	Domestic	International
Terminal Floor Area (Sqm)	46,359	1,50,000
Annual Terminal Passenger Capacity (mppa)	6.5	8.5
Terminal Floor Area/Design mppa	7,132	17,647
Terminal Design Peak Hour passengers (PHP)	4,000	4,000
Terminal Floor Area/PHP	12	38
Cost Data (New International Terminal)		
Total Estimated cost (in million INR)		6,500
Total Indexed cost (in million INR)		-
Estimated cost per mppa (in million INR)		1,121
Estimated cost per sqm of GFA (in INR)		43,333

Note: The estimated cost for the new international terminal at Cochin Airport considers the fit-out for phase-1 only (until 2021 for a terminal capacity of 5.8 mppa), whereas the building shell is being constructed for the ultimate phase till 2027-28. Consequently, the final and fully completed cost for the new international terminal will be higher than the cost mentioned in the table above and the same would be impacted by factors such as additional aerobridges, finishes, HVAC, conveyor belts, check-in islands, lifts, escalators, building finishes, IT systems, etc. Further, the development to take place at a later period would also entail cost escalation on account of price escalation in materials and labour due to inflation, statutory levies, exchange rate fluctuations, increase in fuel prices and level of finishes / quality. The indexation is not required since it is estimated cost and the completion period is year 2016.

Source: The above data has been sourced from the websites of AERA and the respective airport operator and from details available in public domain. Traffic data has been sourced from the AAI website.

3.5 Benchmarking vis-a-vis Kempegowda International Airport

The components compared for the benchmarking exercise are as follows:

1) Annual Passenger and Aircraft Traffic - The composition of international and domestic traffic governs the terminal size. The traffic mix at benchmarked airports has been analyzed to establish the differences in the mix and size of other benchmarked airports vis-à-vis Kempegowda International Airport.

2) Terminal Area Development – Areas of recently constructed/planned terminals at the benchmarked airports have been compared with respect to their design peak hour passengers. The variation in areas per PHP between benchmarked airports is analyzed to assess key factors for variation between the benchmarked airports and the same also highlights that no two airports are alike.

3) Cost of New Terminal Building Development – The costs of development of recently constructed/planned terminal buildings are compared using two parameters - designed passenger capacities and areas provisioned. While, area parameter relates to comparison of actual size and quality of facility constructed, the annual passenger capacity parameter relates to comparison on account of facility's productivity and efficiency. ICAO also uses productivity/efficiency as a key 'Performance Indicator' for airports performance. As per ICAO, cost effectiveness refers to the financial input or costs required to produce a non-financial output i.e. total cost per passengers.

4) Quality of Construction – The quality of construction of the terminals has been ascertained through visual inspection and is intended to highlight the quality achieved vis-à-vis the cost incurred. It also provides a comparison of the differences in the quality provided at the benchmarked airports.

5) Airport Service Quality – We recognize that it is 'delivered' service that matters. The varying service levels being delivered at the benchmarked airports as measured through the ACI ASQ survey are analyzed in detail. This analysis providing further justification for the costs incurred at the various airports and also demonstrates a linkage between quality of construction and perceived service quality.

Findings of the Key Benchmarking Components

During site visits and from information collected from various sources we note that, of the benchmarked airports, new passenger terminals at Delhi, Mumbai, Bangalore, and Kolkata Airports are operating as integrated terminals, whereas Chennai and Cochin Airports are developed / proposed as non-integrated facilities. For Delhi and Mumbai Airports, the analysis has been undertaken for integrated terminals only (T-3 for Delhi and T-2 for Mumbai).

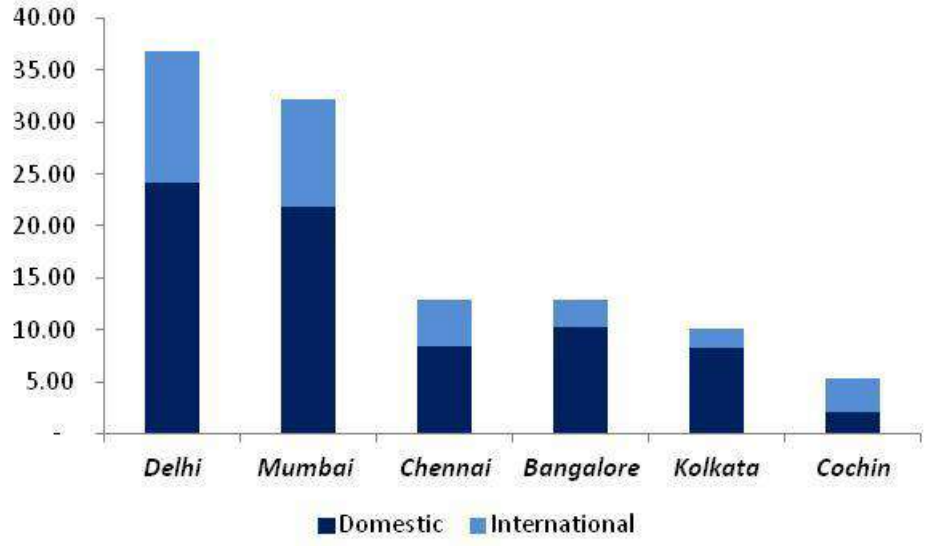
3.5.1 Annual Passenger and Aircraft Traffic

Annual passenger traffic for the year ending 31st March 2014, segregated for domestic and international passengers, at each benchmark airport is shown in Figure 1 below. Delhi Airport is the largest airport in terms of annual passengers handled in FY2013-14, followed by Mumbai Airport. Of the benchmarked airports, Bangalore Airport is the fourth largest airport, after Delhi,

Mumbai and Chennai Airports, in terms of annual passenger handled. Cochin Airport is the smallest in terms of passenger traffic.

Figure 1: Annual Passenger Traffic at Benchmarked Airports (YTD 31st March 2014)

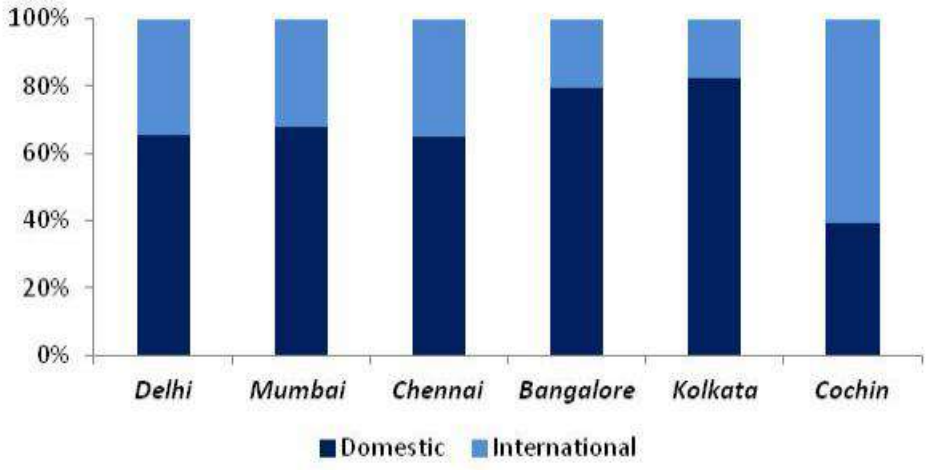
In million



As shown in Figure 2 below, the share[5] of domestic passenger traffic at Delhi, Mumbai and Chennai Airports is around 65-67%. At Bangalore and Kolkata Airports, the share of domestic passenger traffic is higher than other benchmarked airports at around 80%. At Kolkata Airport, the gateway to the eastern and north-east regions, the share of domestic traffic is high. Also, Kolkata Airport is the main business centre in the eastern region. Bangalore is considered as an IT-hub and provides access to major educational centers in the region resulting in high domestic traffic at the airport.

Cochin Airport, on the other hand, has a high share of international traffic (around 60%), primarily driven by gulf countries-based traffic from Kerala.

Figure 2: Percentage Share of Domestic/International Passengers (YTD 31st March 2014)



[5] Airports Authority of India website (www.aai.aero)

Aircraft Movements

As the passenger traffic increases, the number of aircraft movements (ATMs) also tends to increase, unless there is a significant introduction of large aircraft which may decrease the number of movements. The possibility of better utilization of aircraft due to a higher average passenger load factor (PLF) may also reduce the number of movements.

Similar to the passenger traffic, Delhi Airport has the highest annual aircraft movements, followed by Mumbai Airport. Chennai Airport is the third largest, followed by Bangalore Airport. Cochin Airport, being a smaller airport, has less ATM traffic than the other benchmarked airports.

Figure 3: Annual Aircraft Movements for Benchmarked Airports (YTD 31st March 2014)

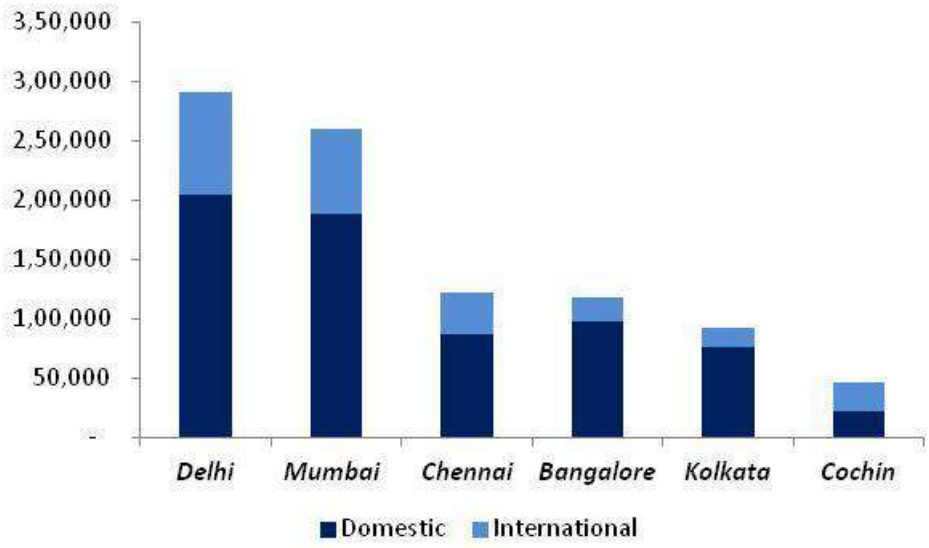
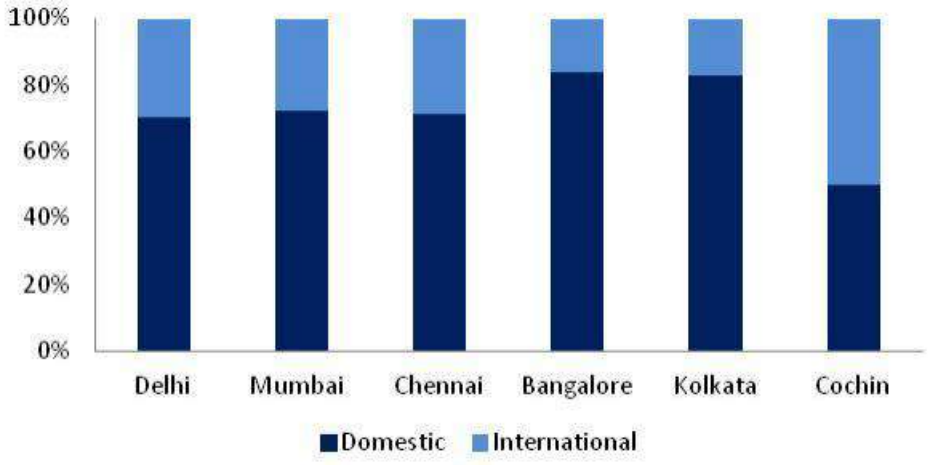


Figure 4: Percentage Share of Domestic/International ATMs (YTD 31st March 2014)



3.5.2 Terminal Area Development

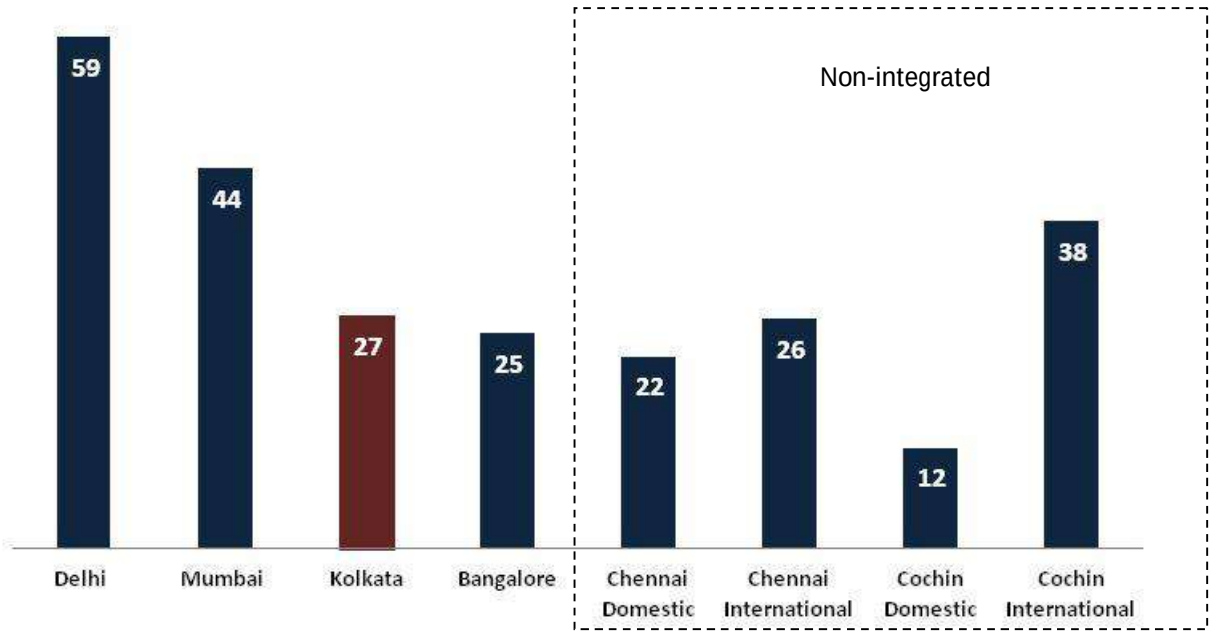
Brief details of the upgraded integrated terminal processing facilities at the benchmark airports are provided in Table 8 below:

Table 8: Comparison of New Terminal Floor Areas

Description	Delhi	Mumbai	Kolkata	Bangalore	Chennai Domestic	Chennai International	Cochin Domestic	Cochin International
Type of Terminal Processing	Integrated	Integrated	Integrated	Integrated	Non - Integrated		Non - Integrated	
Terminal area constructed / proposed (sqm)	5,53,887	4,31,672	1,98,692	1,61,110	72,614	60,528	46,359	1,50,000
Terminal Passenger Capacity								
- Annual (mppa)	34	40	20	20	10	4	6.5	8.5
- Peak Hour Passenger (PHP)	9,450	9,900	7,450	6,540	3,300	2,300	4,000	4,000
Terminal Floor Area per mppa	16,291	10,792	9,935	8,056	7,261	15,132	7,132	17,647
Terminal Floor Area per PHP	59	44	27	25	22	26	12	38

Of the benchmarked airports, the integrated terminals at Delhi and Mumbai Airports are large as compared to Bangalore Airport. The terminal sizes at Kolkata and Cochin Airports (integrated and non-integrated respectively) are larger than the integrated Bangalore Terminal-1 by around 25%. The combined Chennai Airport non-integrated terminal size is smaller than the integrated terminal at Bangalore Airport.

Figure 5: Terminal Floor Area per PHP (Sqm)



Delhi, Mumbai and Bangalore Airports have integrated facilities. At Delhi and Mumbai Airports, the terminal floor area per PHP is around 44-59 sqm (much higher than seen at Bangalore Airport). While, Bangalore Airport has a high share of domestic traffic (around 80%), the

benchmarked terminals at Delhi (T-3) and Mumbai (T-2) Airports mainly cater to international traffic. Domestic operations require less space provision because domestic passengers carry fewer items of luggage for short distance travel and there is no requirement to provide certain facilities such as emigration, immigration and customs checkpoints. Also, as per industry benchmarks, the average processing time per passenger for check-in is less in the case of domestic passengers compared to international passengers and this impacts on the degree to which facilities and space need to be provided.

Kolkata Airport is considered as an integrated terminal facility, however, we noted during our visit to the airport that international and domestic operations are undertaken from separately defined areas within the same building. Discussions with the airport operator revealed that the total peak hour passenger throughput/capacity is considered as the sum of the domestic and international peaks. Therefore, it is not a truly integrated facility. If the peaks would have been considered for fully integrated usage (simultaneous domestic and international traffic – as considered at other integrated facilities), the combined peak hour capacity provision could have been lower.

As mentioned in Table 8 above, the terminals at Bangalore and Kolkata Airports are designed for 20mppa. Further, the traffic distribution between domestic/international passengers (80:20 respectively) is also similar for both the airports. However, the Bangalore Airport PHP is 6,540 which is lower than the Kolkata Airport PHP of 7,450. As discussed above, if the Kolkata Airport PHP is calculated for a truly integrated facility (as at Bangalore Airport), the PHP would probably be lower than the current domestic and international combined estimate.

As a result, in a truly integrated scenario the terminal area per PHP for Kolkata Airport would increase from the current estimate of 27 sqm per PHP.

Chennai and Cochin Airports have completely non-integrated facilities. The Chennai Airport terminals are designed for 22 and 26 sqm per PHP for domestic and international passengers respectively. However, the Cochin Airport new international terminal is designed for 38 sqm per PHP and the domestic terminal is at 12sqm per PHP.

The Bangalore Airport terminal is an integrated terminal with a design capacity of 25 sqm per PHP. From our discussions with BIAL we note that there were space constraint limitations for the upgrading of the old terminal due to availability of only a limited depth which permitted expansion of the facilities only on the sides of the building. The compliance with IMG norms should therefore not be construed as a satisfactory situation because the resultant space was influenced by the limitations of the site, a single level on the kerb side and extension being undertaken around an operational facility.

Terminal Area Benchmarking Key findings:

- Delhi T-3 and Mumbai T-2 are bigger terminals with higher capacity and primarily have international operations resulting in higher areas per PHP than Bangalore Airport.
- Chennai Airport is a non-integrated development and provides 22sqm and 26sqm per PHP for domestic and international passengers respectively.
- Kolkata Airport, although being integrated, is planned for separate domestic and international operations as evidenced by PHP calculations. If the PHP would have been calculated as a truly integrated facility, the area per PHP would be much higher at Kolkata Airport compared to Bangalore Airport.
- The Cochin Airport new international terminal is designed for much higher areas per PHP and domestic terminal for much lower areas per PHP when compared with IMG norms.
- The limitations on the expansion of Bangalore Airport terminal need to be acknowledged. The PHP for Bangalore Airport is 12% lower than that at Kolkata Airport, whereas, the terminal size is 25% lower than that at Kolkata Airport.

3.5.3 Cost of New Terminal Building Development

The cost of recently built terminal buildings at the benchmarked airports is presented in Table 10 below.

With respect to the costs determined in Table 10, we note the following:

- Delhi Airport – The total cost is as given in the AERA consultation paper. However, we note that a detailed break-up of the cost is not available.

- Mumbai Airport – We are given to understand that the cost of the city-side canopy is considered in the terminal cost, while the canopy area is not considered in the total terminal area.

- Kolkata Airport – The cost for the elevated roads are included in the cost for the Kolkata Airport terminal, however, the same is excluded in the case of terminal buildings at other airports (wherever applicable).

- Chennai Airport – This is a non-integrated terminal and the cost of both the new domestic and international terminals have been consolidated.

- Cochin Airport – We have been informed by Cochin Airport officials that the new international terminal building core is currently being developed for a terminal area of 150,000 sqm to cater for passenger demands up to 2028. However, the finishes and installations would be restricted to serve only phase-1 requirements up to 2021.

- Bangalore Airport – We are given to understand that the cost of the city-side canopy is not considered in the terminal cost and the canopy area is also not considered in the total terminal area. The cost of entry and exit roads is excluded. However, as the entire upgraded facility (including the old terminal building portion of 73,627sqm) is operating as a single

integrated unit, the cost of Phase-1 of T-1 (terminal building portion), as provided by BIAL, has been considered.

For comparison purposes, changes have been considered in areas and costs as shown in Table 9 on the basis of the following:

- Delhi Airport – Revised Area as *per DIAL, mentioned in EIL report (refer AERA Consultation Paper No.2/2011-12).*
- Mumbai Airport - Revised cost to completion and area have been considered as per data obtained from MIAL.
- Bangalore Airport - Based on BIAL response to AERA queries dated 5th November 2013 and 18th December 2013.
- Kolkata Airport – Based on AAI submission to AERA vide letter no: AAI/CHQ/REV/AERA/AS/2012 dated 8th August 2012.
- Chennai Airport - based on AAI submission to AERA vide letter no: AAI/CHQ/REV/AERA/AS/2012 dated 8th August 2012.

Table 9: Proposed Terminal Cost and Area Changes

Sr. No.	Airport	Area as per AERA report in Sqm	Corrected Area in Sqm	Cost as per AERA report (in INR Million)	Corrected Cost (in INR Million)
1	Delhi – Terminal 3	533,887	553,887		
2	Mumbai - New Terminal T2	4,39,512	4,31,672	50,830	54,000
3	Bengaluru - Terminal 1 Expansion (Phase 2)	85,000	87,483	12,352	11,055
	Bengaluru - Terminal 1 (Phase 1)	-	73,627	-	8,400
	Total for Bengaluru Terminal 1	85,000	161,110	12,352	19,455
4	NSCBIA, Kolkata – New Integrated Terminal Building			15,530	21,546
5	Chennai – New Domestic and International Terminal			15,470	14,765

Further, as the construction of the benchmarked terminals have been undertaken/proposed at different periods of time, the costs have been indexed to the current period (June 2014), so as to enable equal comparison of these costs. The indexed costs are presented in Table 10 below.

The Cost Indices related to the Mumbai, Delhi, Bangalore, Chennai and Kolkata Airport development periods under 'Urban Infra' have been sourced from The Construction Industry Development Council - CIDC website for analysis. The cost indices are available for various locations / cities on a monthly basis.

Table 10: Indexed Cost of Terminal Buildings at Benchmarked Airports

Particulars	Unit	Delhi	Mumbai	Kolkata	Chennai	Cochin	Bangalore		
							Phase-1	Phase-2 (Expansion)	Total (Phase 1 + 2)
Terminal capacity	Mppa	34	40	20	14	5.8	11.5	8.5	20
Terminal Area	Sqm	553,887	431,672	198,692	133,142	150,000	87,483	73,627	161,110
Total Actual Cost	INR mn	68,360	54,000	21,546	14,765	6,500	8,400	11,055	19,455
Total Indexed Cost	INR mn	82,117	54,120	22,706	14,974	6,500	10,413	11,082	21,495
Indexed Cost per mppa	INR mn	2,415	1,353	1,135	1,070	1,121			1,075
Indexed Cost per Sqm	INR	148,257	125,374	114,280	112,467	43,333			133,420
Cost Indices applied:									
Completion date		July'10	Feb'14	Aug'12	Sep'12	May'16	Dec'08	Dec'13	
Cost indices prevailed at the time of Project completion under 'Urban infra'		116.77	138.74	131.12	128.04	-	107.98	133.53	
Cost indices on June 2014 for respective city		140.27	139.05	138.18	129.85	-	133.86	133.86	
Cost indexation applied to actual costs		20.13%	0.22%	5.38%	1.41%	-	23.97%	0.25%	

Note: The estimated cost for the new international terminal at Cochin Airport considers the fit-out for phase-1 only (until 2021), whereas the building shell is being constructed for the ultimate development phase till 2028. The cost per mppa has been calculated based on the design passenger capacity till 2021, i.e. 5.8 mppa.

The Cost Indices related to the Mumbai, Delhi, Bangalore, Chennai and Kolkata Airport development periods under 'Urban Infra' have been sourced from The Construction Industry Development Council - CIDC website for analysis. The cost indices are available for various locations / cities on a monthly basis.

Figure 6 – Indexed Cost per Terminal Capacity (INR million/mppa)

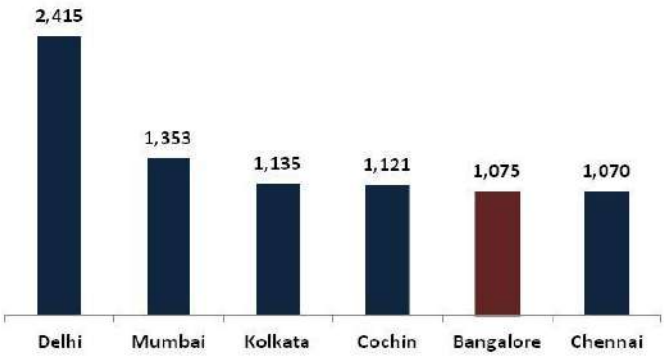
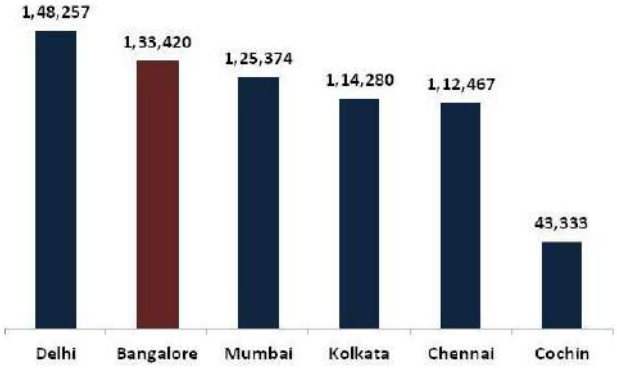


Figure 7 – Indexed Cost per Sqm (INR)



Kolkata and Chennai Airports are not bound by concession agreements requiring them to comply with prescribed service levels/quality of construction etc., apart from AAI's own standards and requirements. From discussions at Kolkata Airport, we understand that AAI, being the owner and operator of several airports, has the advantage of economies of scale by centralizing procurement of high-value items such as aerobridges etc. For example, AAI has placed a bulk order for the supply of aerobridges to multiple airports. This provides cost advantages to AAI as compared to other airport operators.

Regarding the cost related to the construction of the new international terminal at Cochin Airport, we have, during discussions with the airport operator, been informed that the terminal is planned as a low cost facility relying mostly on local products and finishes. Further, the airport recognizes that it is not governed by any concession agreement requiring fulfillment of any specific standards or those governed by AAI norms. This provides a high degree of flexibility to the airport operator in any planning, including provision of relatively basic service qualities as depicted in a low cost per sqm ratio.

As can be seen in Figure 7 above, the cost per sqm for AAI airports and Cochin Airport are lower than other benchmarked airports.

Figure 6 above provides benchmarking by comparing terminal development cost based on each million passengers processed per annum (mppa). This alternative measure demonstrates relative cost efficiency at different terminals by showing the cost expended for each million annual passenger capacity.

It is noted that, while there is a significant cost variation amongst the various benchmarked airports on a per sqm basis, the cost per mppa is generally uniform except in the case of Delhi Airport.

While Figure 7 indicates Bangalore airport terminal is more expensive than Kolkata and Chennai (when compared on cost per sqm basis), Figure 6 indicates that Bangalore terminal is cheaper than Kolkata and similar to Chennai (when compared on cost per mppa basis).

Similarly, Cochin's proposed new international terminal is cheaper than all other benchmarked terminals on a cost per sqm basis; however, its cost is higher than Bangalore and Chennai on cost per mppa basis.

Furthermore, in the case of Delhi Airport, an area of 553,887 sqm is provided to process 34 million annual passengers, at a cost of INR 2,415 million per mppa. At Mumbai Airport, a much smaller area of 431,672 sqm is provided to process 40 million annual passengers, at a comparative cost of INR 1,353 million per mppa.

The benchmarking analysis therefore indicates that, while the cost per sqm is related to the quality of construction and service, the cost per mppa relates more to productivity and asset utilization and the 'value for money' of the terminal development cost vis-à-vis the amount of annual passengers processed.

Also, significant variation in the results obtained from cost per sqm and cost per mppa, clearly indicates that there is 'no single parameter' which is complete in itself for comparing two different terminals.

Terminal Development Costs Key findings:

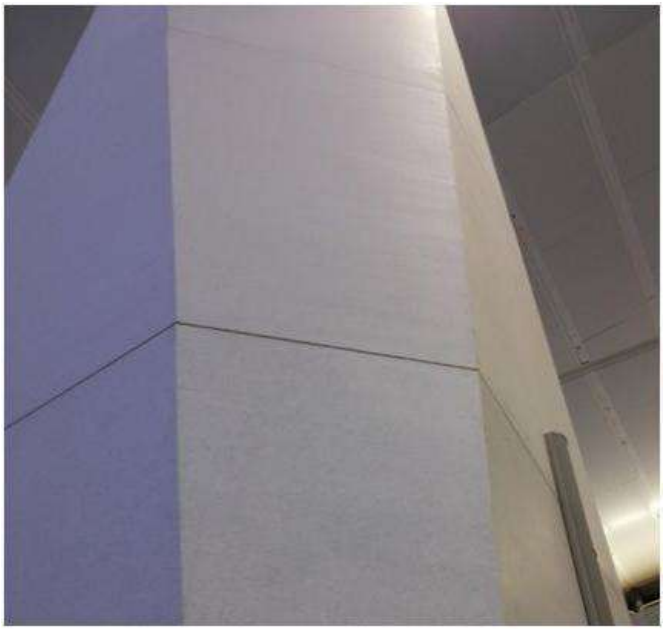
- The costs of development of terminal building for PPP airports are governed by unique factors as compared to AAI/other Private airports, these factors include:
    - Concession Agreements stipulating strict service levels and requirements for enhanced quality of construction; and
    - No cost advantage available for bulk procurement of high-value items.
- The cost for the development of the Bangalore Airport terminal when compared with other benchmarked airport terminals, particularly the AAI and Cochin Airport terminals, appears to be competitive taking into account the following:
    - The cost per mppa of Bangalore Airport is lower than that at Kolkata and Cochin Airports and similar to that at Chennai Airport indicating better asset utilization and a more cost effective terminal at Bangalore Airport.
    - The need for additional capital costs to ensure that the various airport facilities that are measured as part of Concession Agreement service level requirements are built with sufficient capacity to meet peak hour forecast demands.
    - No economies of scale cost advantage available in the procurement of high-value items.
    - Brown-field operational site requiring enabling works and additional costs arising from restrictions on movement during construction around a live airport operation.
- The benchmarking analysis indicates that, while terminal development when measured on costs per sqm basis are related to the quality of construction and service, the cost per mppa measure relates to productivity/asset utilization and effectiveness.
- Significant variation in the results obtained from cost per sqm and cost per mppa, indicates that there is 'no single parameter' which is complete in itself for comparing two different terminals.

3.5.4 Quality of Construction

In order to assess the quality of construction at the benchmarked airports, the facilities at each airport were visited.

Delhi Airport – T3

The departure concourse of T-3 at Delhi Airport is a large expanse with a glass façade and granite flooring. All column and wall claddings are of permanent finishes with high quality of materials and construction. The general ambience of this area is of a superior nature. The check-in counters are in moulded metal sheets, provided in an island type layout. These are standardized and colourful providing a pleasant environment. The railings provided are in stainless steel which minimizes maintenance and replacement costs. All entry gates are provided in glass for easy maintenance and to improve the general ambience of the area. Ceilings and walls are also provided in metal sheets which provide a permanent finish, not requiring periodic painting. The quality of work executed is of superior quality as has been noted from the joinery of stone and metal works carried out for flooring, walls and ceilings.




GMR


Gates 29-36
Gate 28

Mumbai Airport

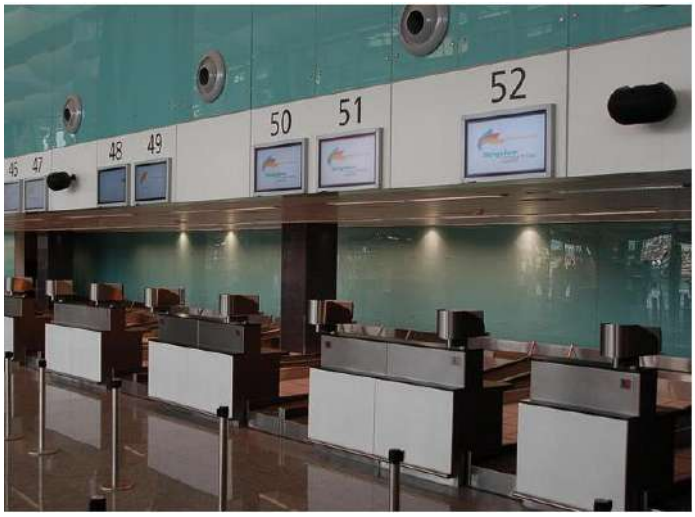
The public concourse on the city side of T-2 at Mumbai airport has been provided with permanent finishes for seating, columns, railings, stairways, etc. The ceiling for the terminal building has been constructed with very high quality glass/fibre reinforced cement concrete through high quality workmanship, which provides a highly superior ambience throughout the terminal area. This would also minimize maintenance requirements.

The building glass façade and entry gates are synchronized and the work was executed with a very high quality of finishing. The various areas of the terminal have reflected synchronized wall cladding, flooring, partitions, advertisement panels, signage, lighting etc. This provides a highly superior ambience for the traveler. The check-in counters are in moulded metal sheets, provided in an island type lay-out. The railings, directional signs and advertisement panels are in brushed stainless steel, requiring less maintenance.

The quality of work executed at T-2 is of superior quality as has been noted from the joinery of stone and metal works carried out for flooring, walls and ceilings.

Bangalore Airport

The departure concourse of the upgraded terminal at Bangalore has high quality granite flooring and has a glass façade separating the public concourse and the passenger concourse. The quality of finishes is of a high standard. The check-in counters are standardized and of uniform colour and material, which add to the ambience of the check-in hall. Signage provided throughout the terminal is standardized in material, design and colour and provides appropriate directions for users. Seating arrangements within the terminal are durable and maintenance free. The ceiling in the extended portion of the terminal has been provided in high quality aluminium strips with concealed lighting which add to the ambience of the building. Commercial areas have been properly designed incorporating modern materials, lighting, finishes and signage, equivalent to the much larger airports at Delhi and Mumbai. All column and wall claddings are of permanent finishes with high quality of materials and construction. The quality of construction executed is of superior quality and is observed to be much better when compared to the AAI airports at Kolkata and Chennai.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52


Departure Gates
Medical Services
Security Check
Baby Care
Immigration
Shopping


at Bengaluru

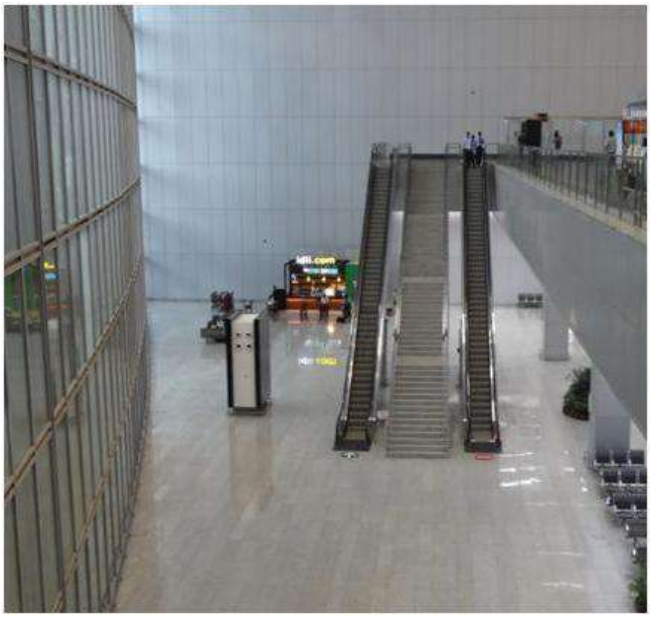
Kolkata Airport

The city-side kerb on the arrival and departure levels has been provided with granite floorings which have been reasonably well finished. Advertisement panels, railings, staircases, seating areas and ceilings have been standardized and provide a high level of ambience to the airport.

The façades, both on the air and city sides, have been provided with totally glazed frontages with reportedly medium level quality of execution. Glass panels have been reported to fall during strong winds[6]. All gates and entry points are provided in glass which avoids the requirement of periodic painting and enhances the character of the terminal. Marble flooring is provided. Wall and column claddings are executed in aluminium metal panels thereby minimizing the cost of replacement and periodic painting. The execution of flooring, wall and column claddings is of a superior quality. However, our view is that it is of a relatively lower level of quality than that seen at Delhi and Mumbai Airports. Check-in counters and seating have been provided with permanent materials which minimize maintenance costs.

Overall the quality of construction and finishes provided at Kolkata Airport are of a good quality, however, they are relatively lower in quality when compared with Delhi, Mumbai and Bangalore Airports.

[6] *http://timesofindia.indiatimes.com/city/kolkata/Breeze-shatters-glass-wall-at-new-terminal/articleshow/19026475.cms*

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before Check in
spicejet
B
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go
B
IndiGo
C


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Chennai Airport

The visitors' kerbs on the arrival and departure levels have been provided with granite flooring reasonably well finished. However, there are signs of water penetration which indicates poor workmanship and materials. Signage, though colour coded, is not up to the same high standards as seen at airports such as Delhi, Mumbai and Bangalore. Advertisement panels, railings, staircases have been standardized. However, in our view the quality provided is average, especially in respect of seating areas. All gates and entry points are provided in glass which avoids the requirement for periodic painting and enhances the character of the terminal. The façades, both on the air and city sides, have been provided with totally glazed frontages with medium level quality of execution. The execution of flooring has been carried out in tiles which presently look good but, over a period of utilization, would require high maintenance in terms of replacement. Wall surfaces have been plastered and painted. Check-in counters appear to be locally fabricated and do not provide a good ambience. Overall, we suggest that the quality of construction and finishes provided at the Chennai Airport new terminals are of medium quality.

It has been reported that the toilets[7] provided at the terminal are not of international standards and are reported to be shabby with water leakages. The quality of workmanship is sub-standard[8] and it has been widely reported that several false ceiling panels had fallen down at the new facilities.

[7] http://www.thehindu.com/news/cities/chennai/shabby-toilets-at-new-international-terminal-in-chennai/article4918393.ece

[8] http://www.sify.com/news/chennai-airport-s-new-terminal-is-a-joke-news-chennai-nfvisKdicaisi.html


SECURITY CHECK


3
2

Cochin Airport

A review of the facilities at the existing terminal, which is to be converted to handle all domestic flights without major changes of finishes, shows that the visitor kerb side, although provided with granite flooring, is poorly constructed without concern for the overall finishes. Column claddings and the ceiling of the kerb side are in cement plaster with painting, requiring periodic maintenance and generally give a poor appearance. The façade is partially in glass with small glazing areas which only acts as a divider between the kerb side and departure concourse. The flooring in the departure concourse is in tiles which have aged over a period of time. The seating arrangement uses large wooden chairs with fabric upholstery not commensurate with modern interiors. Advertisement panels are in various sizes and in some cases are hand-painted. It has also been observed that check-in counters are primitive and fabricated in timber. The overall ambience of the terminal building is not comparable to the interiors of modern airport terminal facilities.

As is understood from the airport operators, a basic facility has been provided without any requirement for enhanced service quality and standards.


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GOVT. OF INDIA, COCHIN

The quality of construction, as described above, has been assessed on the basis of visual inspection of facilities on a scale of 1 to 5. Our analysis is compiled in Table 11 below.

Table 11: Visual Assessment of Quality of Construction at Benchmarked Airports

Sr. No.	Facilities reviewed	Delhi	Mumbai	Kolkata	Chennai	Bangalore	Cochin	Average (Excl. Cochin)
1	General ambience of visitor area	4	4.5	3	2.5	3.5	2	3.5
2	Flooring	4	4.5	3.5	2.5	4	2	3.7
3	Façade	4	4	4	3	4	2	3.8
4	Ceiling	4	4.5	4	2.5	4	2	3.8
5	Wall cladding	4	4.5	3	2.5	4	1.5	3.6
6	Column cladding	4	4.5	3.5	3	4	1.5	3.8
7	Check-in counters	4	4.5	3	3	4	2	3.7
8	Toilets	4	4.5	3	2	4	2	3.5
9	Doors, gates, railings	4	4.5	3	2	4	2	3.5
10	Directional Signages	4	4.5	3	2.5	4.5	2	3.7
11	Advertisement panels	4	4.5	3.5	3.5	4	2.5	3.9
12	Lifts, escalators, travellators	4	4.5	3.5	3	4	2	3.8
	Average	4	4.5	3.3	2.7	4	2	3.7

Quality of Construction Key findings:

- On an overall evaluation, the facilities at Delhi and Mumbai Airports are of very high and superior quality. The maintenance cost of the finishes has been minimized by virtue of providing permanent finishes.
- Facilities at Chennai and Kolkata Airports, although completed recently, are rated as average according to the visual inspections carried out. Both of these terminals have been reported for shortcomings in the quality of construction executed.
- The new international terminal at Cochin Airport is under construction. The existing international terminal, proposed to be converted to a domestic terminal, was inspected and found to be of low quality of construction, as compared to other benchmarked terminals. This can be related to the low cost of development of the terminal.
- At Bangalore Airport, the quality of construction is generally evaluated as high. The same is also reflected in the high ASQ ratings for Bangalore Airport for Q2-2014 and in the significant improvement in the ASQ scores from earlier quarters:
    - The quality of construction at Bangalore Airport is far superior to that at Chennai Airport taking into account the cost of development.
    - The Kolkata Airport terminal is better rated than Chennai Airport; however, it is rated below the Bangalore Airport terminal.
    - Bangalore Airport provides better quality of construction and higher customer satisfaction (ASQ) as compared to the AAI owned airports at Chennai and Kolkata.
- In conclusion, it can be inferred that, in general terms, the quality of construction is directly related to the cost of construction.

3.5.5 Airport Service Quality (ASQ)

AERA guidelines require airport operators to measure and report quality of service under objective and subjective performance standards. The performance standards defined by AERA relate to the 34 parameters identified in the ACI Airport Service Quality (ASQ) program, (refer to Annexure B for an extract of AERA's guidelines).

Of the 34 service quality measures reported in the ACI ASQ survey, the following 12 measures have been analysed in our study. These 12 measures have been selected as they relate to the provisioning of terminal facilities which directly influence the requirement for areas and therefore the overall terminal sizing.

1. Overall satisfaction with the airport;
2. Waiting time in check-in queue line;
3. Waiting time at passport/ personal ID inspection;
4. Waiting time at security inspection;
5. Arrivals Passport and Visa inspection;
6. Restaurant/ Eating facilities;
7. Shopping facilities;
8. Availability of washrooms/toilets;
9. Comfort of waiting/gate areas;
10. Cleanliness of the airport;
11. Ambience of the airport; and
12. Speed of baggage delivery services.

The ASQ Survey data for last four quarters (Q3 FY13, Q4 FY13, Q1 FY14 and Q2 FY14) have been provided by BIAL, which have been analysed below.

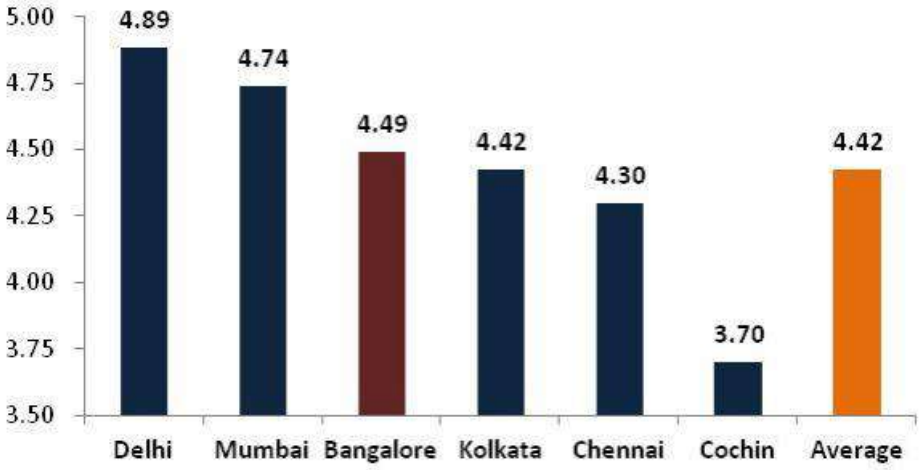
a) Overall Satisfaction with the Airport

Overall satisfaction with the airport is an important factor and is driven by factors both within and outside the control of the airport operator. Factors within the control of airport operator would include cleanliness, comfort of movement, ease of processing, convenience of way finding, comfortable hold areas, shopping alternatives etc. Factors outside the airport operator's control would normally include security clearing time, check-in by airlines, baggage delivery and even availability of flights etc.

Figure 8 below shows the overall satisfaction at the benchmarked airports for the quarter Q2 FY2014. The average level of the benchmarked airports is 4.42. Delhi, Mumbai and Bangalore Airports are above the average. While, Chennai and Kolkata Airports are below / equal to the average, Cochin Airport is at a much lower level. Bangalore Airport is providing higher customer satisfaction than Kolkata and Chennai Airports.

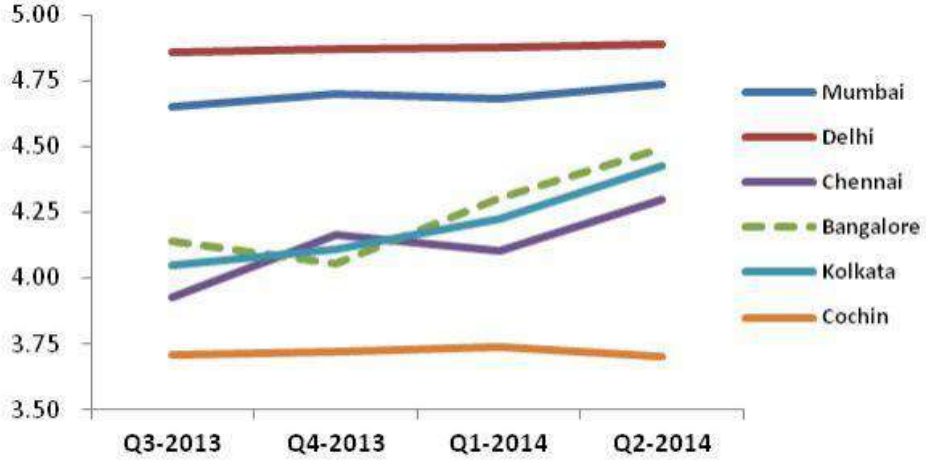
Cochin Airport, as mentioned earlier, is developed as a low cost facility. During discussions with the airport operator, we were informed that Cochin Airport does not participate in the ACI ASQ survey but is independently undertaking service ranking surveys through ACI accredited agencies. It is understood that Cochin Airport does not aspire to provide high service levels and is satisfied with the basic service levels.

Figure 8: ASQ Overall Satisfaction with the Airport (Q2-2014)



As per the ASQ ratings for the last 4 quarters (see Figure 9 below), it can be seen that the ratings at Delhi and Mumbai Airports have remained constant, most probably because their ratings were at the high end of the scale in Q3FY2013 and have been maintained thereafter. Also, it is noted that the Delhi and Mumbai Airport facilities are more spacious and the quality of finishes, maintenance etc. are superior to those at other airports. The terminal area per sqm at Delhi and Mumbai Airports is in the range of 46-59 sqm per PHP, whereas at Bangalore, Kolkata and Chennai Airports, it is in the rage of 22-27sqm per PHP.

Figure 9: ASQ Trend in Overall Satisfaction with the Airport



For Bangalore, Kolkata and Chennai Airports, there has been an improvement in the Overall Satisfaction Rating over the previous quarters, notably due to upgrades and commissioning of new terminal facilities at the airports. The above Figure 9 depicts that, subsequent to the recent upgrade of its facilities, Bangalore Airport is ranked higher than Kolkata and Chennai Airports.

For Cochin Airport, the data indicates that the service level has generally been lower at 3.70, which has, by and large, been the rating over the last 4 quarters.

b) Waiting Time at Check-in Queue /Line

Check-in counters are key facilities requiring a large footprint which significantly impact on the level of service provided, terminal development cost and operations. The waiting time at check-in facilities is directly related to the number of counters made available by the operator. These facilities are manned by handling agents/airlines and this could result in different standards of service at different airports.

Figure 10 below indicates the ASQ Waiting Time at Check-in Queue/Line service level at 4.47 for the benchmarked airports. Delhi, Chennai and Bangalore Airports are higher / equal to the average. The service level for Delhi Airport has been above 4.50 during the last 4 quarters (Figure 11), the service levels at Bangalore and Chennai Airports have improved significantly, primarily due to commissioning of new facilities.

The service level for Mumbai Airport has been in the range of 4.25 - 4.50 (this range is driven by check-in operations being carried out at other terminals, besides T-2, for domestic operations).

Subsequent to the commissioning of new terminal facilities at Kolkata Airport, the service level has remained flat in the range of 4.25 – 4.30.

Figure 10: ASQ Waiting time at Check-in Queue /Line (Q2-2014)

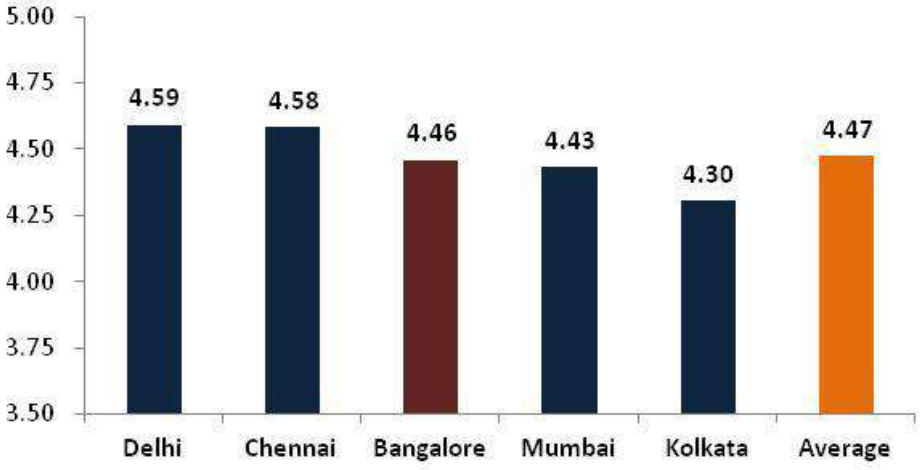
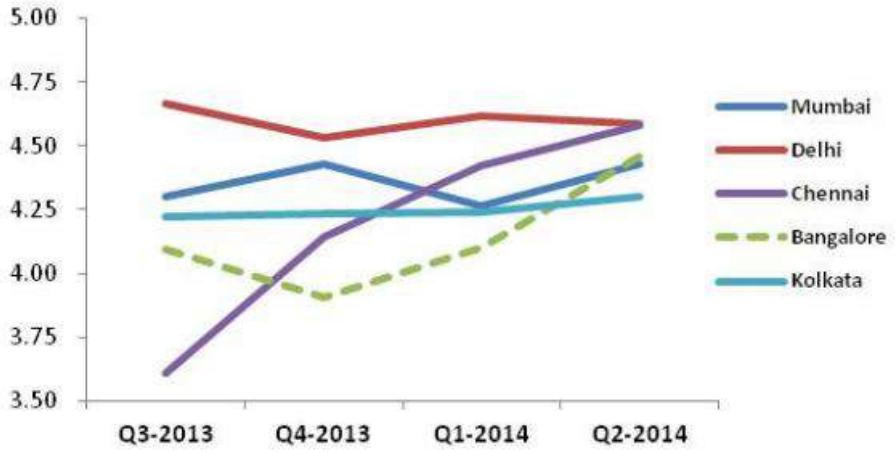


Figure 11: ASQ Trend in Waiting Time at Check-in Queue /Line

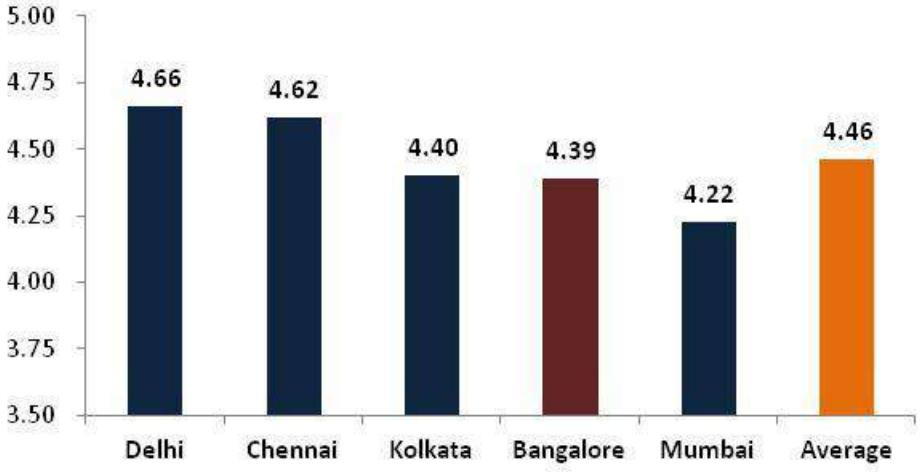


c) Waiting Time at Passport/Personal ID Inspection (Emigration)

The passport control functions at departures (as well as at arrivals) are under the purview of the Ministry of Home Affairs, Government of India. Although procedures vary from country to country, in the present analysis, all of the airports being benchmarked are in India and therefore the local drivers such as technology, procedures, passenger profiling etc. are expected to be the same. However, staffing levels by the national authority will influence the waiting times over which the airport operators have little or no control.

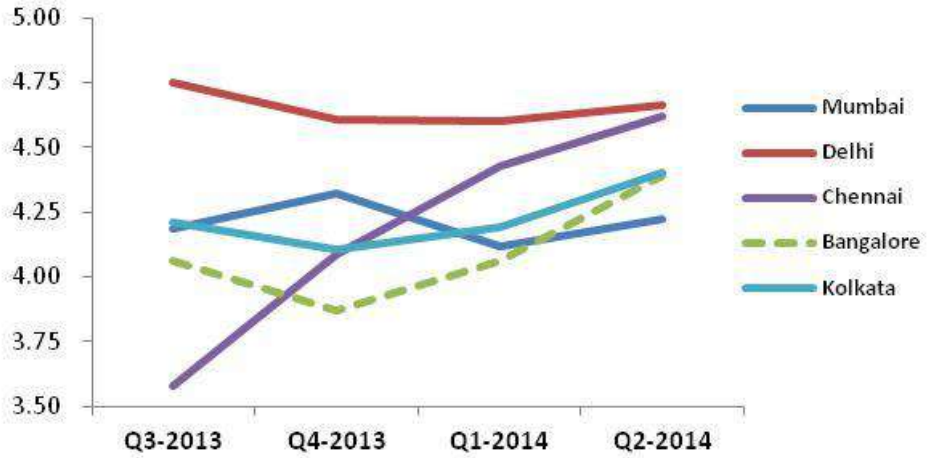
The ASQ rating for the Waiting Time at Passport/Personal ID Inspection parameter for Q2-2014 is presented in Figure 12. It is noted that the rating at Delhi and Chennai Airports are at a relatively high level compared to the other airports and also above the average of 4.46. The ratings for Bangalore and Kolkata Airports are lower than the average. However, for Mumbai Airport, the rating is much lower at 4.22. The number of emigration counters provided at Mumbai Airport is 60 for a total terminal capacity of 40mppa, as compared to Delhi Airport where the number of counters provided is 49 for a total terminal capacity of 34mppa (the split between international and domestic passengers at Delhi and Mumbai Airports is similar). However, at Mumbai Airport T-2, the emigration check is after the security check (as against other benchmarked airports where emigration is immediately after check-in and before security check).

Figure 12: ASQ Waiting Time at Passport/Personal ID Inspection (Q2-2014)



From Figure 13 below, it is noted that at Delhi and Mumbai Airports the trend in the Waiting Time at Passport/Personal ID inspection service level has remained relatively flat. For, Chennai, Kolkata and Bangalore Airports, the trend clearly indicates substantial improvement in the service levels, primarily due to recently commissioned upgraded facilities.

Figure 13: ASQ Trend in Waiting Time at Passport/Personal ID inspection

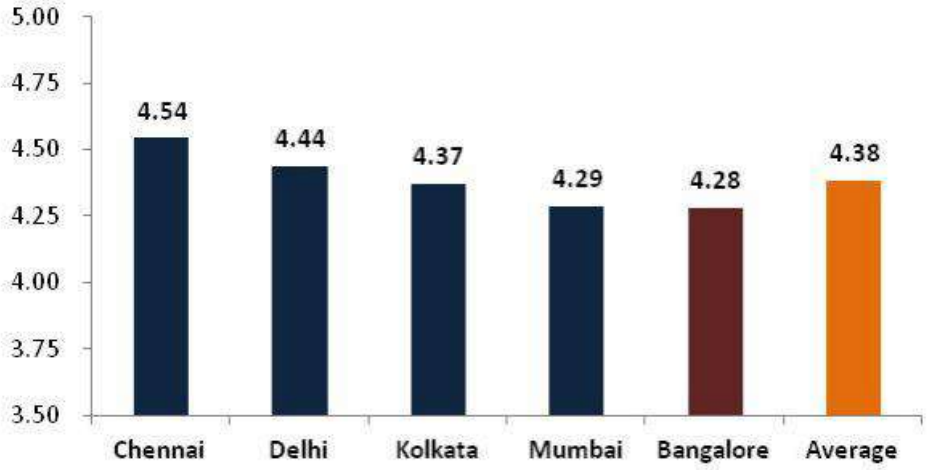


d) Waiting Time at Security Inspection

A passenger's focus on security clearing time is an important aspect of their overall airport experience. The security inspection at Indian airports falls under the purview of the Central Indian Security Force (CISF). The standards of checks and profiling, including enhanced checks during perceived threats, are generally similar for all benchmarked airports.

The ASQ Waiting Time at Security Inspection levels at the 4 benchmarked airports as measured in Q2-2014 are shown in Figure 14 below. The average has been determined at 4.38. The levels at Delhi, Chennai and Kolkata Airports are above / equal to the average. However, the levels for Mumbai and Bangalore Airports are lower (at around 4.28-4.29) than the average for the benchmarked airports.

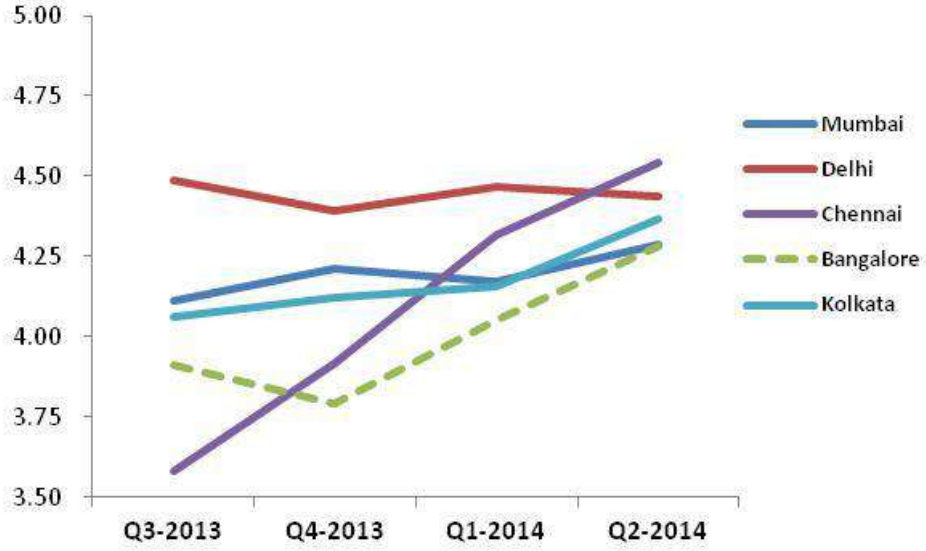
Figure 14: ASQ Waiting Time at Security Inspection (Q2-2014)



The graph at Figure 15 below shows a constant level of service quality at Delhi Airport over the last 4 quarters. However, at the other airports a marked improvement has been recorded, especially at Bangalore Airport where the service quality has improved substantially from 3.79

to 4.28 due to the commissioning of upgraded terminal facilities. This is a clear indication of the improved services and enhanced facilities being instrumental in providing better service quality.

Figure 15: ASQ Trend in Waiting Time at Security Inspection



e) Arrivals Passport and Visa inspection (Immigration)

As mentioned above, passport control at arrivals is under the purview of the Ministry of Home Affairs, Government of India over which the airport operators have little or no control.

The ASQ rating for the Arrivals Passport and Visa Inspection waiting time parameter for the Q2-2014 is presented in Figure 16 below. It is noted that the ratings at Delhi, Chennai and Kolkata Airports are higher than or equal to the average of 4.55. The ratings for Bangalore and Mumbai Airports are similar at 4.45 and lower than the average. The facilities at Mumbai Airport are being progressively operationalized and the rating for Bangalore Airport has shown an improvement from Q3-2013.

Figure 16: ASQ Arrivals Passport and Visa Inspection (Q2-2014)

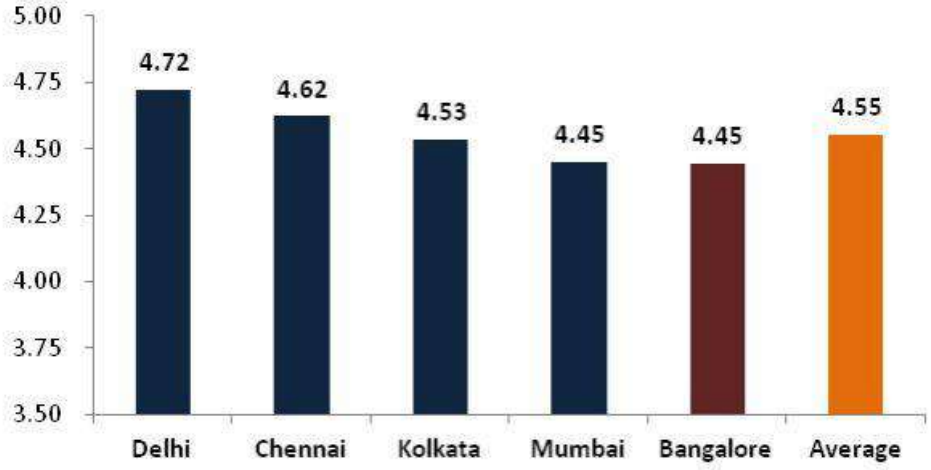
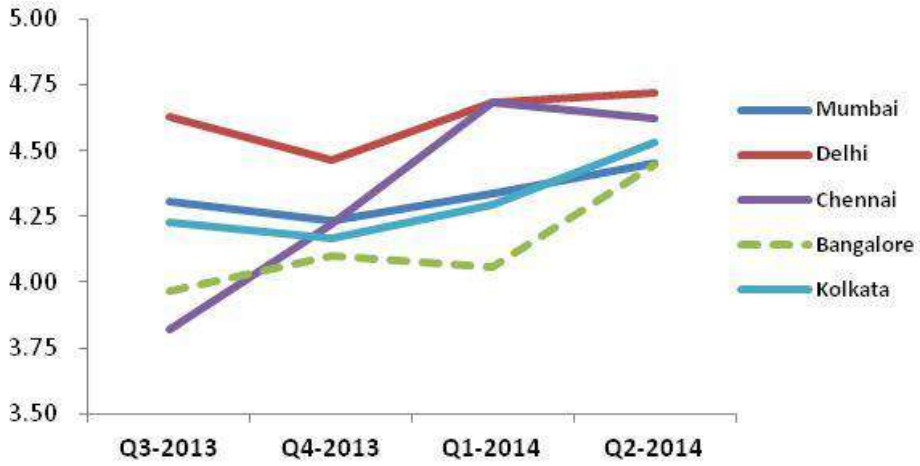


Figure 17: ASQ Trend in Arrivals Passport and Visa Inspection



f) Airport Facilities

Passengers using airport facilities require a variety of services conforming to an individual's needs. To ensure coverage of all classes of passengers, several types of facilities may be required to be provided by the operators. However, there are some essential facilities which need to be provided while provision of others may only be necessary or viable at the larger airports. It may, however, be noted that satisfaction of the customer as well as the commercial returns to an operator are important factors for an airport operator.

In the case of the benchmarked airports, the service quality standards for the following airport facilities have been compared:

i. Restaurant/ Eating facilities;
ii. Shopping facilities;
iii. Availability of washrooms/toilets; and
iv. Comfort of waiting/gate areas.

Table 12: Comparison of ASQ Scores for Airport Facilities at Benchmarked Airports

Restaurant/ Eating Facilities

Airport	Bangalore	Delhi	Mumbai	Chennai	Kolkata	Average
Q3-2013	3.85	4.64	4.25	3.38	3.59	**3.94**
Q4-2013	3.81	4.22	4.26	3.70	3.65	**3.93**
Q1-2014	3.81	4.29	4.22	3.91	3.74	**3.99**
Q2-2014	4.35	4.28	4.31	3.94	4.13	**4.20**

Shopping Facilities

Airport	Bangalore	Delhi	Mumbai	Chennai	Kolkata	Average
Q3-2013	3.59	4.57	4.24	3.59	3.48	**3.89**
Q4-2013	3.71	4.36	4.30	3.75	3.48	**3.92**
Q1-2014	3.73	4.28	4.19	3.88	3.62	**3.94**
Q2-2014	4.25	4.57	4.21	4.02	3.89	**4.19**

Availability of Wash Rooms/Toilets

Airport	Bangalore	Delhi	Mumbai	Chennai	Kolkata	Average
Q3-2013	4.19	4.79	4.22	3.81	3.93	**4.19**
Q4-2013	4.17	4.77	4.41	4.09	3.96	**4.28**
Q1-2014	4.37	4.79	4.36	4.15	4.08	**4.35**
Q2-2014	4.47	4.84	4.35	4.54	4.31	**4.50**

Comfort of Waiting/Gate Areas

Airport	Bangalore	Delhi	Mumbai	Chennai	Kolkata	Average
Q3-2013	4.08	4.76	4.23	3.70	4.03	**4.16**
Q4-2013	4.04	4.73	4.31	3.72	4.05	**4.17**
Q1-2014	4.32	4.75	4.31	4.07	4.14	**4.32**
Q2-2014	4.23	4.77	4.37	4.30	4.35	**4.41**

It is observed from the above tables that the service levels for the selected airport facilities have generally shown increasing trends at all airports over the last 4 quarters. One of the key factors that can be associated with such a trend is the more recent commissioning of the new facilities at the benchmarked airports (except Delhi Airport). In the case of Delhi Airport, the service levels have generally been maintained at the same levels over the last 4 quarters.

Kolkata and Chennai Airports are generally below the average, whereas Delhi and Mumbai Airports are above the average. Bangalore Airport has been generally consistent at the average level.

g) Airport Environment

The environment of the airport is an important parameter for evaluating a user's satisfaction. The components tracked by ACI in the ASQ survey include cleanliness and ambience of the airport. The ASQ survey result shows that Bangalore Airport provided a clean and ambient environment consistently over the survey period.

Table 13: Comparison of ASQ Scores for Airport Environment at Benchmarked Airports

Cleanliness of Airport Terminal

Airport	Bangalore	Delhi	Mumbai	Chennai	Kolkata	Average
Q3-2013	4.31	4.85	4.42	3.93	4.19	**4.34**
Q4-2013	4.17	4.84	4.49	4.25	4.22	**4.39**
Q1-2014	4.32	4.85	4.47	4.43	4.26	**4.47**
Q2-2014	4.48	4.82	4.52	4.59	4.47	**4.58**

Ambience of the Airport

Airport	Bangalore	Delhi	Mumbai	Chennai	Kolkata	Average
Q3-2013	4.21	4.83	4.44	3.86	4.15	**4.30**
Q4-2013	4.07	4.82	4.47	3.99	4.14	**4.30**
Q1-2014	4.34	4.78	4.47	3.89	4.29	**4.35**
Q2-2014	4.47	4.73	4.47	4.13	4.50	**4.46**

h) Speed of Baggage Delivery Service

The efficiency of baggage delivery is not only dependent on the number of belts but also on the efficiency of the handling agents/airlines on the airside for baggage delivery. Such a variation is governed by the performance of individual handling agents/airlines and is somewhat outside of the control of the operator.

It is noted from Figure 18 below that Delhi, Mumbai and Bangalore Airports are above the average for the Speed of the Baggage Delivery Service, whereas Kolkata and Chennai Airports are below the average.

Figure 18: Speed of Baggage Delivery Service (Q2-2014)

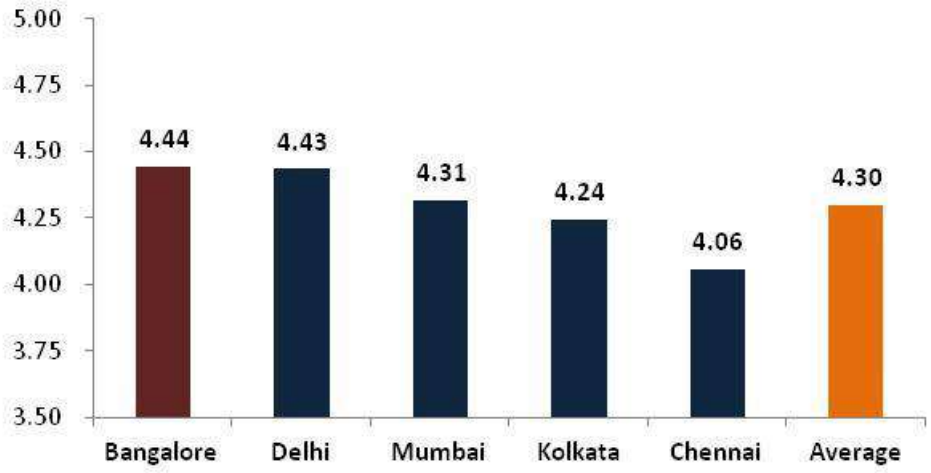
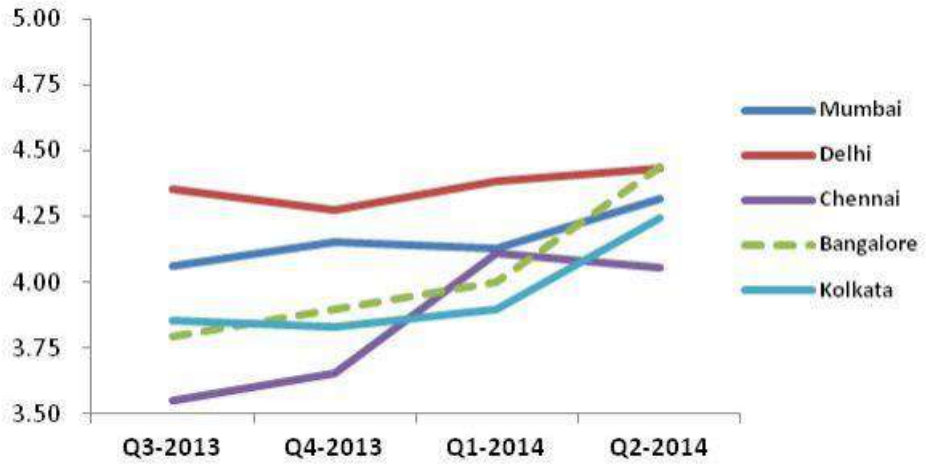


Figure 19: ASQ Trend in Speed of Baggage Delivery Service



Airport Service Quality Key findings:

- Delhi and Mumbai Airports are generally rated at high service levels.
- Bangalore, Kolkata and Chennai Airports have shown significant increase in the recorded service levels over the last 4 quarters primarily due to the commissioning of new terminal facilities.
- Bangalore Airport, as compared to Kolkata and Chennai, is rated high in most of the parameters, thereby indicating high level of satisfaction being provided at Bangalore Airport:
    - The area for the Kolkata Airport terminal is more than the area provided at Bangalore Airport. However, the service levels at Bangalore are higher than at Kolkata Airport.
    - The cost of development per sqm at Bangalore Airport seems to correlate with the high service levels achieved at Bangalore Airport.
- Cochin Airport does not participate in the official ACI ASQ rating but undertakes its own customer satisfaction surveys using ACI-accredited agencies. The rating for overall customer satisfaction as published by Cochin Airport is significantly lower when compared to the same rating achieved at Bangalore Airport.

3.6 Section 3 Conclusions

- Benchmarking of the Bangalore Airport terminal has been undertaken with comparison to the integrated terminals at Delhi, Mumbai and Kolkata Airports and the non-integrated terminals at Chennai and Cochin Airports.

- From the benchmarking exercise, it can be clearly inferred that no two terminals are alike and they differ in all the parameters considered for the benchmarking and that a single set of standards do not apply to any two airports.

- The share of domestic traffic at Delhi, Mumbai and Chennai Airports is around 65-68%, whereas at Bangalore and Kolkata Airports it is around 80%. In the case of Cochin Airport domestic traffic (40%) is less than international traffic.

- Delhi T-3 and Mumbai T-2 are designed for higher capacity and primarily have international operations resulting in higher areas per PHP than Bangalore Airport. The recorded service levels at Delhi and Mumbai Airports are higher than those at Bangalore Airport and the quality of construction is also superior to that at Bangalore airport. Accordingly, the cost per sqm of construction of Delhi T-3 is higher than that at the Bangalore Airport terminal.

- Chennai Airport is a non-integrated development. The airport, being AAI owned, is not governed by any concession agreement requirements as compared to PPP airports. The service levels achieved at Chennai Airport are generally lower than other benchmarked airports on most of the service quality parameters, except Cochin Airport. Even the quality of construction observed at the Chennai Airport new terminals are comparatively average when compared with Delhi, Mumbai or Bangalore Airports. Accordingly, the cost per sqm of development at Chennai Airport is lower than that at Delhi, Mumbai, Bangalore and Kolkata Airports.

- Kolkata Airport is planned for separate domestic and international operations as evidenced by PHP calculations, however, it is considered as an integrated terminal. If the PHP would have been calculated as a truly integrated facility using the combined and coincident domestic and international passenger flows (as opposed to the time-separated but summed domestic and international passenger flows), the area per PHP would likely be higher at Kolkata Airport than that at Bangalore Airport.

  Similar to Chennai Airport, Kolkata Airport too is not governed by any concession agreement requirements as compared to PPP airports. The recorded service levels achieved at Kolkata Airport, though higher than at Chennai Airport, are lower than the service levels recorded at Delhi, Mumbai and Bangalore Airports on most of the parameters. The quality of construction observed at the Kolkata Airport new terminal is average when compared to Delhi, Mumbai and Bangalore Airports.

- The Cochin Airport new international terminal is designed for much higher areas per PHP and the domestic terminal for much lower areas per PHP when compared with IMG norms. The airport is not bound by any concession agreement containing AAI standards/norms and therefore the airport operator has a high degree of freedom in its planning and operational activities. The airport is also not obliged to participate in the ACI ASQ rating and the service quality reports published by the airport itself reveal a significantly lower overall satisfaction rating as compared to other benchmarked airports. Further, the quality of construction observed was also very basic and reflected the low cost model adopted by the airport.

- Being a PPP airport, Bangalore Airport is governed by a concession agreement requiring compliance with specified service levels. The ASQ ratings for Bangalore Airport are observed to be higher than those at the AAI airports (Chennai and Kolkata Airports) and much higher than the overall ASQ score recorded at Cochin Airport. The quality of construction observed at Bangalore Airport is also superior to that observed at Chennai, Kolkata and Cochin Airports.

  The capital cost of the Bangalore Airport terminal, when evaluated on cost per mppa basis, is lower than that at Kolkata and Cochin Airports and similar to that at Chennai Airport.

  It is noted that the cost of the Bangalore Airport terminal development would have been affected by factors such as the concession agreement requirement to meet high service levels, limitations of development at the brown-field operational site (i.e. having to work around a live airport terminal operation) and no cost advantage in the procurement of high-value items (bulk ordering). Considering the cost per mppa measure, it is inferred that the Bangalore Airport terminal is more efficiently utilized and on this basis is more cost effective than most of the other benchmarked airports.

- Significant variation in the results obtained from cost per sqm and cost per mppa parameters are noted, and it is inferred that there is 'no single cost parameter' which is complete in itself for comparing two different terminals. Thus, the Authority should not limit comparison on cost per sqm norm only; other parameters such as cost per mppa, which relate more to productivity and asset utilization and the 'value for money' of the terminal development cost, should also be considered.

Section 4

Cochin International Airport: Case Study

4 COCHIN INTERNATIONAL AIRPORT – CASE STUDY

4.1 Introduction

AERA in its Consultation Paper No. 5/2014-15 dated 12th June 2014 has included Cochin Airport as a comparable airport amongst much larger airports such as Delhi, Mumbai, Chennai, Bangalore and Kolkata Airports.

Accordingly, a case study on Cochin Airport is undertaken as part of this exercise to study the characteristics of operations at Cochin Airport. This case study is intended to examine whether Cochin represents a valid model for 'all' airports in India and is an appropriate comparator with other benchmarked airports.

The approach adopted for the study was as follows:

- Discussion with airport operator to understand the objectives of airport planning and development;
- Comparison of facilities provisioned at Cochin Airport vis-à-vis other benchmarked airports based on data available in the public domain and also obtained after discussions with the airport operator;
- Comparison of service quality levels for Cochin Airport vis-à-vis other benchmarked airports as per ASQ ratings; and
- Comparison of the quality of construction at Cochin Airport (existing terminals) as per the visual inspection vis-à-vis other benchmarked airports.

The data for Cochin Airport has been obtained from the following sources:

- Reports, Consultation Papers, Orders, Minutes of Stakeholder meetings, stakeholder presentations, etc. downloaded from AERA's website;
- Data provided by BIAL;
- Discussion with officials of Cochin airport; and
- Data from industry sources.

4.2 Planning and Development Aspects at Cochin Airport

Cochin Airport presently operates two separate terminals for domestic and international passengers. The domestic terminal was developed in 1999 and is operating beyond its maximum passenger handling capacity, which has resulted in congestion during peak hours. The existing international terminal has a peak hour handling capacity of 2,400, whereas the current throughput is less than 2,400.

As per the new expansion plan, the international terminal is to be converted completely into a domestic terminal, while a new international terminal of 150,000 sqm is to be built on the eastern side of the existing structure having segregated arrivals and departures at different levels. The existing domestic terminal is planned to be converted to a VIP/General Aviation terminal.

The new international terminal building is planned for 8.5[9] million annual passengers for the target year 2028. However, the fit-out for the phase-1 construction is planned for a passenger handling capacity of only 5.8 million passengers annually for the target year 2021.

Table 14: Development Phases of the New International Terminal at Cochin

Traffic	2021	2028
Phase	1	2
MPPA	5.8	8.5
PHP	2,900	4,000

The fit-out for Phase-2 is planned to be installed after 2021 to cater for the additional requirement to meet the ultimate handling capacity of 8.5 million annual passengers by 2028.

The estimated cost for development of the new international terminal is around INR 6,500 million. This cost only takes into account the facilities/fit-out required to meet the requirements till 2021. The completed cost for the terminal for 2028 would entail provision for additional fit-out such as aerobridges, finishes, HVAC, conveyor belts, check-in islands, lifts, escalators, building finishes, IT systems, etc. not included in the initial cost. Furthermore, the development at this later period would also entail cost escalation on account of price escalation in materials and labour due to inflation, statutory levies, exchange rate fluctuations, increase in fuel prices and level of finishes / quality. Since accurate estimates of the completed facility, 5-7 years from now, would not be feasible due to lack of information (designs, specifications, etc.), the cost of the fully completed facility has not been calculated. Thus, the costs of terminal development at Cochin Airport have not been benchmarked with other airports.

As per our discussions with the airport operator, we understand that the following key planning and development aspects have generally adopted at Cochin Airport:

- While Cochin Airport is also an international airport, it is generally understood that it caters to a different target customer than the other benchmarked airports. We understand that one of the factors considered during the original development of the airport concept was to cater to the traffic between Kerala and the middle-east countries which then comprised mainly of overseas workers.
- As a result, the endeavor is to provide basic functional facilities with a local flavor and mostly indigenous materials.
- Cochin Airport, being a non-PPP airport and neither under the fold of AAI, has a high degree of freedom and flexibility in the planning and development of the facilities. The designs, specifications and development model are not bound by any requirements for meeting any defined additional service levels, superior quality of construction, development norms etc. As a result, Cochin Airport is independently able to define its model (low cost model) considering the target customer segment and provide designs, specifications and implementation accordingly, to suit the low cost model.

  As an example, the terminal area per PHP planned for Cochin Airport is as below:

[9] As per AERA Consultation Paper No. 03/2014-15, page 12, the estimated passenger traffic at Cochin is 10.3 million by 2021 and 15 million by 2028. On Page 13 of same document, break-up of total traffic of 10.3 million is provided (domestic: 4.5 million and international: 5.8 million). The break-up for 15 million by 2028 is extrapolated in the same ratio.

- Domestic operations - 12sqm (lower than any of the benchmarked terminals); and
- New International operations - 38sqm (higher than some of the benchmarked terminals at Bangalore, Kolkata and Chennai Airports).

Also, the design year for Cochin airport is 2028, which is over 14 years from the start of planning. As per IMG norms, the terminal building planning should be for 7 years from the date of planning for airports having more than 5mppa. This has generally been the approach of other benchmarked airports.

Considering the above, we infer that the factors associated with the planning / development of Cochin Airport is different from other benchmarked airports. The model and approach adopted by Cochin Airport may be relevant in the specific case of Cochin, considering its unique positioning, however, they would not ideally be comparable to other benchmarked airports such as those at Delhi, Mumbai, Bangalore, Kolkata and Chennai where the target customer market, development models, regulatory regime and service level requirements/aspirations are very different.

4.3 Comparison of Facilities Provisioned at Cochin Airport vis-à-vis Other Benchmarked Airports

The information for the benchmarked airports and Cochin Airport (the proposed international terminal and upgraded domestic terminal) is presented in Table 15 below.

Table 15: Calculation of Average Benchmark Airport Data and Comparison with Cochin Airport

Sr. No.	Parameters	Units	Delhi	Mumbai	Bangalore	Kolkata	Chennai	Average	Cochin	Cochin is lower than Avg. Value
1	Total Airport Area	Acre	5,060	1,967	4,008	1,670	1,283	2,798	1,300	2 times
2	Total Airport capacity (Existing/Currently under-development)	mppa	63	50	20	24	23	36	15	2.4 times
3	Annual Passengers Traffic (YTD 31 March 2014)	mppa	36.9	32.2	12.9	10.1	12.9	21.0	5.4	4 times
4	Annual Domestic Passenger (YTD 31 March 2014)	mppa	24.2	21.9	10.2	8.3	8.4	14.6	2.1	7 times
5	Annual International Passenger (YTD 31 March 2014)	mppa	12.7	10.3	2.6	1.8	4.5	6.4	3.3	2 times
6	Annual ATM Traffic (YTD 31st March 2014)	No.	2,90,772	2,60,666	1,17,728	92,817	1,21,817	1,76,760	46,029	3.8 times
7	Domestic ATM (YTD 31st March 2014)	No.	2,04,581	1,88,306	98,420	76,909	86,549	1,30,953	22,893	5.7 times
8	International ATM (YTD 31st March 2014)	No.	86,191	72,360	19,308	15,962	35,268	45,818	23,136	2 times
9	Type of Terminal Building		Integrated	Integrated	Integrated	Integrated	Non-Integrated		Non-Integrated	-
10	Terminal Compared		T3	T2	Expanded T1	New Terminal			New International & Upgraded Domestic	-
11	Terminal Floor Area (sqm)	Sqm	5,53,887	4,31,672	1,61,110	1,98,692	1,33,142	2,95,701	1,96,359	1.5 times
12	Design capacity in mppa	mppa	34	40	20	20	14	26	15	1.7 times

The analysis of Cochin Airport, based on the information in the above Table 15, is as below:

i. Size of the Airport

The average size of the five international benchmark airports is 2,798 acres whereas the area of Cochin Airport is only 1,300 acres, less than half of the average value.

ii. Total Airport Capacity

The total airport capacity for the 5 benchmark airports is in the range of 20-63 mppa and their average is 36 mppa. In comparison, the total airport capacity for Cochin Airport will be 15 mppa, which is two times lower than the benchmark average.

iii. Passengers per Annum

For the year ending 31st March 2014, the average passenger traffic at the benchmark airports was 21 million, whereas at Cochin Airport it was only 5.38 million passenger movements, almost four times lower than the average annual passenger traffic at the benchmark airports.

The average domestic passenger traffic for the year ending 31st March 2014 at the benchmark airports was 14.60 million, whereas the same for Cochin Airport was only 2.11 million. Similarly, for international passengers, the benchmark average was 6.39 million and for Cochin Airport it was only nearly half of that.

iv. Metro City

All the other benchmark airports serve metropolitan cities where total annual growth of the city population is much higher than that of Cochin, a non-metro city. It is presumed that, the metro cities are able to generate more disposable income which in turn converts to higher air passenger growth.

v. Air Traffic Movements (12 months to end March 2014)

- The average annual ATMs at the benchmark airports were 176,760 whilst at Cochin Airport it was only 46,029, nearly four times less.
- The average annual Domestic ATMs at the benchmark airports was 130,953 and that at Cochin Airport was only 46,029, nearly one-third of that at the benchmark airports.
- The average annual International ATMs at the benchmark airports was 45,818 and the annual international ATMs at Cochin Airport was 23,136, almost half of that at the benchmark airports.

vi. Type of Passenger Terminal Building

All passenger terminal buildings under this study are integrated except at Chennai and Cochin Airports. At non-integrated airports, for transfer between domestic and international flights, passengers with their baggage have to leave the domestic building to arrive at international building and vice versa which is often far away either by bus or by other means.

'Swing' facilities (facilities which can be switched between international and domestic use) are not available at the Cochin Airport terminal building, therefore, for a similar number of peak hour passengers, a higher size building is required to accommodate the passenger volumes when compared to integrated terminals with 'swing' facilities..

vii. Design Year of Passenger Terminal Building

The design year for Cochin Airport is 2028, which is over 14 years from the start of planning. As per IMG norms, the terminal building planning should be for 7 years from the date of planning for airports having more than 5mppa. This has generally been the approach of other benchmarked airports. The planning and development of Cochin Airport would entail non-utilization of constructed facilities.

viii. Number of Floor Levels of the Terminal

The new terminal at Cochin airport will have four levels, while the same is 6 or more for other benchmarked terminals. A higher number of levels at the benchmarked terminals are mainly due to site constraints, therefore, requiring more levels. More levels result in higher costs due to high structural, foundation and project design and management costs. At Cochin Airport, the building is comparatively smaller and there are no apparent site constraints.

As is discussed above, the provisions at Cochin Airport are significantly lower than at the larger benchmark airports. While, it is understood that Cochin Airport's facilities may be sufficient for meeting the local requirements, however, the business model and approach to the provision of airport facilities does not appear to fit with the requirements at much larger airports.

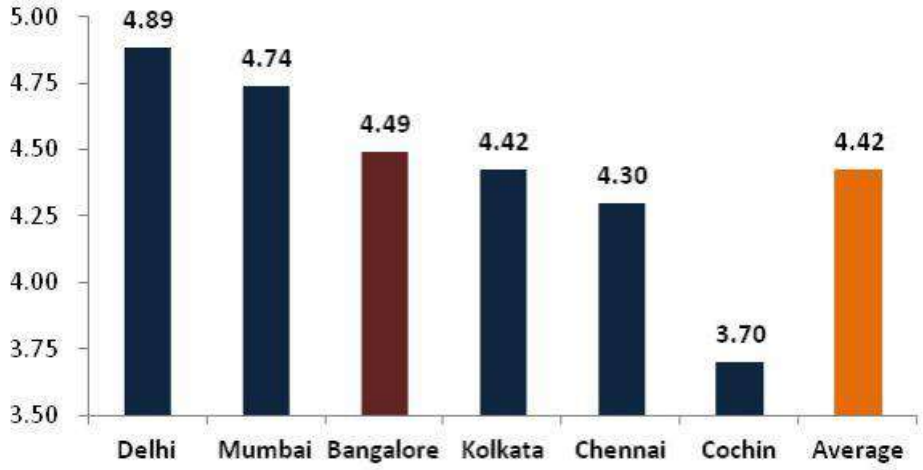
4.4 Comparison of Service Quality Levels for Cochin Airport vis-à-vis Other Benchmarked Airports

As discussed in detail earlier in Section 3, the benchmarked airports participate in the ACI ASQ survey. While Cochin Airport does not participate directly in this survey, it independently commissions service quality surveys by an ACI accredited agency, which may or may not adopt a similar methodology as the official ACI ASQ surveys. The ASQ rating, as published by Cochin Airport, is only available for the 'Overall satisfaction with the Airport' service quality measure.

Overall satisfaction with the airport is an important factor and is driven by factors both within and outside the control of the airport operator. Factors within the control of airport operator would include cleanliness, comfort of movement, ease of processing, convenience of way finding, comfortable hold areas availability of shopping alternatives etc. Factors outside the airport operator's control would normally include security clearing time, check-in by airlines, baggage delivery and even availability of flights etc.

Figure 20 below shows the overall satisfaction at the benchmarked airports and at Cochin Airport for the last quarter Q2 FY2014. It can be seen that Cochin Airport is significantly below the rest of the benchmarked airports in terms of overall passenger satisfaction.

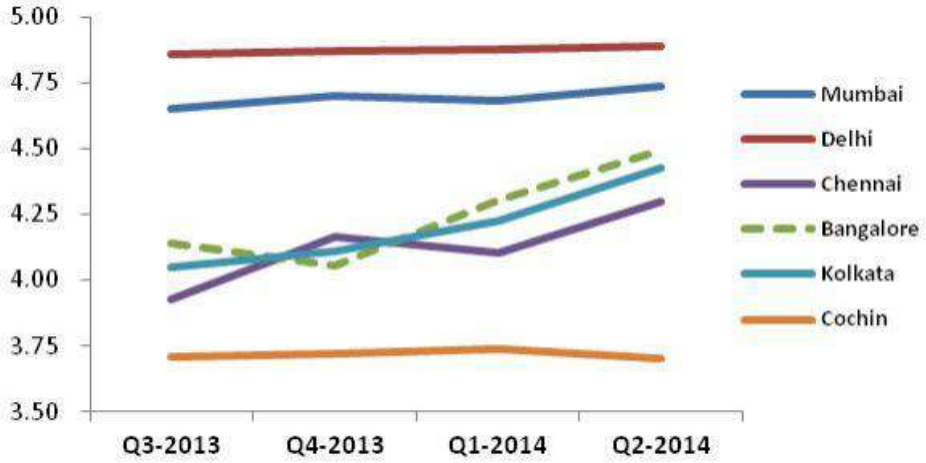
Figure 20: ASQ Overall Satisfaction with the Airport (Q2-2014)



As per the ASQ ratings for the last 4 quarters (see Figure 21 below), it can be seen that the ratings at Delhi and Mumbai Airports have remained constant at a relatively high level. For Bangalore and Kolkata Airports, there has been an improvement over the previous quarters notably due to upgrades and commissioning of new terminal facilities at these airports.

For Cochin Airport, the data indicates that the overall service level has generally been lower at 3.70, which has, by and large, been the rating over the last 4 quarters.

Figure 21: ASQ Trend in Overall Satisfaction with the Airport



We reiterate that Cochin Airport has been developed as a low-cost, functional airport with basic facilities, which serves the requirements of its present users. It is therefore concluded that comparing such an airport with larger airports at metro cities for the purposes of benchmarking and setting norms at these larger airports is not advisable.

4.5 Comparison of Quality of Construction of Cochin Airport (Existing Terminals) vis-à-vis Other Benchmarked Airports

In order to assess the quality of construction, the existing facilities at Cochin Airport were visited. The quality of construction has been analyzed on the basis of visual inspection of facilities on a subjective scale of 1 to 5.

A review of the facilities at the existing international terminal of Cochin Airport, which is to be converted to handle all domestic flights without major changes of finishes, shows that the visitor kerb side, although provided with granite flooring, is poorly constructed without concern for the overall finishing. Column claddings and the ceiling of the kerb side are in cement plaster with painting, requiring periodic maintenance and generally give a poor appearance. The façade is partially in glass with small glazing areas which only acts as a divider between the kerb side and departure concourse. The flooring in the departure concourse is in tiles which have aged over a period of time. Advertisement panels are in various sizes. It has also been observed that check-in counters are primitive and fabricated in timber. The overall ambience of the terminal building is not comparable to the interiors of modern terminal facilities. As is understood from the airport operators, a basic facility has been provided without any requirement for enhanced service quality and standards.

In Section 3 earlier, the quality of construction of the benchmarked terminals has been discussed in detail. For each parameter, the average values of the benchmarked terminals have been compared with the construction quality rating for Cochin Airport.

As per Table 16 below, the overall ambience and the finishes at Cochin Airport are at the lower end of the scale (in comparison with benchmarked airports). Our earlier evaluation of passenger satisfaction monitored through the ASQ parameter 'Overall satisfaction with the Airport' corroborates the findings of the quality of construction provided at Cochin Airport.

Table 16: Visual Assessment of Quality of Construction at Benchmarked Airports

Sr. No.	Facilities reviewed	Average (refer Table 11 above)	Cochin*	Difference
1	General ambience of visitor area	3.5	2	-1.5
2	Flooring	3.7	2	-1.7
3	Façade	3.8	2	-1.8
4	Ceiling	3.8	2	-1.8
5	Wall cladding	3.6	1.5	-2.1
6	Column cladding	3.8	1.5	-2.3
7	Check-in counters	3.7	2	-1.7
8	Toilets	3.5	2	-1.5
9	Doors, gates, railings	3.5	2	-1.5
10	Directional Signages	3.7	2	-1.7
11	Advertisement panels	3.9	2.5	-1.4
12	Lifts, escalators, travellators	3.8	2	-1.8

**Based on visual inspection of existing international terminal at Cochin Airport.*

4.6 Comparison of Cost of Construction of Cochin Airport (Existing Terminals) vis-à-vis Other Benchmarked Airports

The estimated cost for new international terminal at Cochin considers the fit-out for phase-1 only (until 2021), whereas the building shell is being constructed for the ultimate phase till 2027-28, i.e. for 150,000 sqm. Consequently, the completed cost for the new international terminal would be higher than the cost mentioned in the AERA consultation paper and the same would be impacted by factors such as additional aerobridges, HVAC, conveyor belts, check-in islands, lifts, escalators, building finishes, IT systems, etc required for the additional capacity to 2028. Further, the development to take place at the later period would also entail cost escalation on account of price escalation in materials and labour due to inflation, statutory levies, exchange rate fluctuations, increase in fuel prices and level of finishes / quality.

Therefore, it would not be appropriate to consider the terminal cost of Cochin Airport for benchmarking purpose, as the same is not a full cost and is based only on the estimated cost for the partial completion of the terminal.

4.7 Conclusions of the Cochin Airport Case Study

The above analysis of a variety of different parameters clearly indicates the following:

- The target customer segment and relative positioning of Cochin Airport is different from the other benchmark airports that have been compared in this study.
- The existing passenger terminals at Cochin Airport are low cost terminals where the passenger service quality is relatively basic, as compared to larger terminals across India.
- Cochin Airport is not governed by a concession agreement or the need to meet AAI defined service standards, therefore providing the airport operator with a high degree of freedom and flexibility in planning and operations.
- Benchmarked airports such as Delhi, Mumbai and Bangalore Airports have to maintain high ASQ levels to comply with stringent concession requirements.
- The cost of development of the new international terminal at Cochin Airport, as defined in AERA's normative approach consultation paper, is for fit-out till 2021 only, whereas the structure is being constructed for 2027-28. Thus, any norm comparison with respect to cost per area or passenger would be inappropriate.
- The Cochin Airport authority markets the airport as a pioneer in developing a low-cost, functional airport[10]. And whilst there is nothing wrong with that as it serves a particular market, translating that model to other larger airports in India may not be appropriate.

Considering all the above factors, we conclude that Cochin Airport should not be used as a suitable benchmark airport in the setting of norms for larger airports in India.

[10] Presentation dated 17 June 2014 by Cochin International Airport to AERA during stakeholders meeting

Section 5

Establish the Range for Terminal Area and Costs Thereof

5 ESTABLISH THE RANGE FOR TERMINAL AREA AND COSTS THEREOF

5.1 Introduction

AERA in its Consultation Paper No. 5/2014-15, 'Regarding norms for capital costs', has proposed the following for passenger terminal buildings:

a. The authority expects that while finalizing the scope of future capital costs, the Airport Operator would abide by the indicated norms. As illustration:
    i. IMG norms for Terminal Building (For e.g. 25 sqm per peak hour passenger for Integrated Terminal Building)
b. The authority proposes to consider capital cost of terminal building at a cost of INR 65,000 per sqm or actual whichever is lower.

AERA in the same Consultation Paper also quotes Prof. Anne Graham in respect of operational parameters for different airports and lists few influencing costs, revenues and efficiency levels, as follows:

> *"There is no typical airport when it comes to looking at services and facilities provided. Beyond the basic operational functions, different airports have little in common."*

For establishing the range for terminal areas and costs, our analysis has been structured in two parts:

- Analysis for establishing a range for terminal building areas; and
- Analysis for establishing a range for terminal building costs.

5.2 Analysis for Establishing a Range for Terminal Building Areas

5.2.1 Introduction

In order to address the issue raised by AERA regarding the norms for terminal areas, our analysis has taken into consideration the following aspects:

1. Acceptable Level of Service;
2. Terminal area norms recommended by the Inter-Ministerial Group (IMG); and
3. Recommendations of IATA for the provision of terminal areas.

5.2.2 Acceptable Level of Service (LoS)

IATA in their ADRM (9th edition) has formulated a Level of Service Framework. As per the Framework, service levels 'A' to 'F' are defined as given in Table 17 below. The IATA LoS framework has been revised in the 10th edition of ADRM, to redefine the previous 6-point scale of LoS A to E to a simpler 3-point scale of Overdesign, Optimum, and Sub-Optimum.

Table 17: ACI's Level of Service Framework

Level of Service	Description of Service
A	An excellent level of service. Conditions of free flow, no delays and excellent level of comfort.
B	High level of service. Conditions of stable flow, very few delays and high level of comfort.
C	Good level of service. Conditions of stable flow, acceptable delays and good level of comfort.
D	Adequate level of service. Conditions of unstable flow, acceptable delays for short period of time and adequate level of comfort.
E	Inadequate level of service. Conditions of unstable flow, unacceptable delays and inadequate level of comfort.
F	Unacceptable level of service. Conditions of cross flows, system breakdowns and unacceptable delays and unacceptable level of comfort.

IATA now recommends 'Optimum' (equivalent to the former LoS 'C') as the ideal standard that best balances the provision of a good level of service whilst avoiding the cost of over-provision. We note from the IMG recommendation paper (Norms and Standards for Determining the Capacity of Airport Terminals) that IMG also recommends LoS 'C' design standards for the target demand in the design year.

Accordingly, LoS 'C' is considered as a standard while establishing a range for terminal areas.

5.2.3 Terminal Area Norms Recommended by IMG

The Report of the IMG was prepared in September 2008 and revised in January 2009. Recommendations made by the IMG in their January 2009 report 'Norms and Standards for Determining the Capacity of Airport Terminals' include the following:

- Smaller airports with less than 5 million annual capacities shall be designed for the 10th year from the planning year.
- Bigger airports with more than 5 million annual capacities shall be designed for the 7th year from the planning year.

- Adoption of LoS 'C' as per ADRM for the target design year.
- With regards to Unit Area Norms, IMG has provided norms that should be adopted for terminal buildings, (refer to Table 18 below – norms as reproduced from IMG recommendations).

Table 18: IMG Norms for Terminal Area (sqm per PHP)

Sr. No.	Terminal	AAI	IATA	IMG recommendation
1	Domestic Terminals a) Upto 100 PHP b) 100-150 PHP c) 150-1000 PHP d) > 1000 PHP	22-23	25	 12 15 18 20
2	Integrated terminal for handling both domestic and international	24-25	Not mentioned	25
3	International Terminals	27-28	Not mentioned	27.5

From the IMG documentation made available, it has not been possible to ascertain any justification for the area provisions recommended by IMG shown in Table 18 above. In the absence of any justification, or detailed workings on the norms, we are not able to evaluate/analyze the basis and efficacy of the suggested IMG norms. .

It is evident from the above table that IMG has primarily based its recommendations on the norms suggested by AAI for integrated and international terminals. It is important to note that AAI had themselves undertaken construction of integrated terminals. For example Amritsar[11] which was commissioned in February 2009 with an area of 40,175 sqm for a peak hour passenger capacity of 1,200, resulting in 33sqm per PHP. The IMG recommendations for the areas for domestic terminals are significantly less than those proposed by IATA and AAI.

In our view, while the report has stated various design objectives that should be considered to arrive at the above terminal norms, there are additional aspects that have not been explicitly mentioned by IMG in their recommendation, which are generally instrumental in the sizing of terminals as follows:

- Geographical location, terrain and availability of land;
- Configuration of terminal layout;
- Type of Terminal – single, one and half or two level;
- Structural requirements to meet higher seismic zone provisions;
- Operator being a signatory to service standard requirements; as an illustration – 90% of annual passengers to be served by aerobridges increases the requirement for in-contact stands, and therefore pier lengths and consequently areas and costs;
- Requirement of level 5 baggage check which requires additional areas in terminal buildings and additional infrastructure costs;
- Design year for which facilities are to be constructed;
- Interconnection to Metro lines at major airports;
- Recent introduction of additional passenger processes (e.g. visa on arrival process);

[11] GoI Press Release on 25th February 2009 (http://pib.nic.in/newsite/erelease.aspx?relid=47938)

- Security considerations; and
- Competitive positioning of the airport vis-à-vis development in the Asia Pacific region.

Further, it is noted that, although the IMG norms were finalized in January 2009, agreements for privatization of the major international airports were signed much earlier:

- Bangalore - July 2004;
- Hyderabad - December 2004;
- Delhi - April 2006; and
- Mumbai - April 2006.

Integrated terminals were proposed at these airports and the concession agreements signed with the concessionaire required specified service levels to be complied with. These concession agreements do not specify the area and cost levels, but direct the performance standards to be achieved by the concessionaire. The concession agreements also provide for penalties on the concessionaire for non-compliance of the performance standards.

For reference, major influencing provisions of areas and costs as per the concession agreements for Mumbai and Delhi Airports are as below:

- Check-in – Maximum queuing time – 5 minutes for Business Class;
- Check-in – Maximum queuing time – 20 minutes for Economy Class;
- Lift Escalators etc. – 98% availability;
- Baggage Trolleys - 100% availability;
- Availability of flight information – 98%;
- Security Check- 95 % passengers wait less than 10 minutes;
- Passenger served by Aerobridges - 90% of annual International and Domestic passengers;
- Gate Lounges – Seating availability for 80% of lounge population;
- Incorporate reservation for rail link;
- Separate International and Domestic check-in process with island concourse; and
- In respect of quality standards with regard to any facility at the airport, the benchmarking will be the prevailing quality standards as observed in the top five international airports in the Asian region (as ranked on AERA analogous rating) of similar scale and size.

Such provisions, being part of the OMDA, are regulatory and binding in nature for the airport operators and thus, they have significant impact on the design considerations, possibly resulting in increases in area per peak hour passenger, additional equipment, infrastructure requirements and costs thereof. In essence, the achievement of the service standards defined in the concession agreements is in part, a direct result of the amount of space provided. So it seems contradictory to restrict space provision whilst at the same time imposing service quality levels (with financial penalties for under-performance) on the airport operators.

The likely impact of the above provisions on the terminal areas and costs is indicated in Table 19 below:

Table 19: Likely Impact of Selected OMDA Provisions on Terminal Areas and Costs

OMDA Provisions	Likely Impact
Check-in – Maximum queuing time – 5 minutes for Business Class	▪ Increased areas due to higher number of check-in counters to meet the requirement ▪ Cost impact
Check-in – Maximum queuing time - 20 minutes for Economy	▪ Increased areas due to higher number of check-in counters to meet the requirement ▪ Cost impact
Lift, Escalators, etc. availability – 98%	▪ Increased areas due to 98% being served through Vertical and horizontal transfer (VHT) systems ▪ Cost impact
Baggage Trolleys - 100%	▪ Increased areas for high stacking requirement ▪ Cost impact
Availability of flight information – 98%	▪ Cost impact
Security Check- 95 % passengers wait less than 10 minutes	▪ Increased areas due to higher number of security check counters to meet the requirement ▪ Cost impact
Passengers served by Aerobridges- 90% of annual International and Domestic passengers	▪ Increased areas due to increased length of piers required for in-contact stands ▪ Increase in number of Aerobridges ▪ Cost impact
Gate Lounges – Seating availability for 80% of lounge population	▪ Increased areas for higher seating requirements ▪ Cost impact
Incorporate reservation for rail link	▪ Major impact on the designs, circulation, service facilities resulting in increased areas ▪ Cost impact
Separate International and Domestic check-in process with island concourse	▪ Increased areas for higher and segregated check-in requirements ▪ Cost impact
In respect of quality standard with regard to any facility at the airport, the benchmarking will be the prevailing quality standards as observed in the top five international airports in the Asian region (as ranked on AETRA ACI analogous rating) of similar scale and size	▪ High standards requiring more area provisions ▪ Cost impact to meet high standards and specifications

These considerations require that flexibility be offered to the developers/terminal planners to meeting the stringent performance standards directed by the concession agreements.

A comparison of the IMG norms and the areas per peak hour passenger considered at the recently constructed/under-development terminals is given in Table 20 below.

Table 20: Comparison of IMG Norms vis-à-vis Area Provisioning for Benchmarked Terminals

Sr. No.	Terminal	AAI	IATA	IMG	Terminals considered	Sqm/PHP
1	Domestic Terminals > 1000 PHP	22-23	25	20	Cochin-Domestic Chennai – Domestic	12 22
2	Integrated terminal for handling both domestic and international	24-25	Not mentioned*	25	Delhi T-3 Mumbai T-2 Bangalore Kolkata**	59 44 25 27
3	International Terminals	27-28	Not mentioned*	27.5	Cochin-International Chennai – International	38 26

(*) Not mentioned in the IMG report.

(**) As mentioned earlier, for other integrated terminals, the PHP is calculated for simultaneous combined domestic and international traffic. However, in the case of Kolkata Airport, the PHP is based on a summation of the time-separate peak hour calculations for Domestic and International operations. If the Kolkata Airport PHP is calculated for true integrated usage, the sqm per PHP is likely to be higher.

On comparison of the terminal areas with the IMG norms, we note the following:

- For domestic terminals, Cochin Airport is designed for significantly lower areas per PHP, whereas, the Chennai Airport domestic terminal is marginally higher than IMG norms.

- For integrated terminals, Delhi and Mumbai Airports are significantly higher than the IMG norm. The Bangalore Airport T-1 area/PHP is the same as the IMG norm for integrated terminals, however, we recognize the limitations of available width and development around a live operational facility at Bangalore Airport which has resulted in a less than optimal and somewhat constrained layout. For Kolkata Airport, although the areas are marginally higher than the IMG norm, the PHP calculated is not for an integrated terminal, if it was the combined PHP would be lower (because domestic and international peaks do not usually coincide) and therefore the area per PHP would be higher.

- The Cochin Airport new international terminal (under development) is significantly higher than the IMG norm for international terminals, whereas, at Chennai Airport it is marginally lower.

It is noted that each airport by virtue of the traffic handled, airlines serving the airport, route connections, position of the dominant carrier, locational advantages etc. has the potential to become a hub airport. This competitive positioning is generally recognized as a very strategic direction for the future overall development of the airport, region and the country. Some of the large airports in middle-east countries are recognized as global hubs and accordingly drive the growth of the local economy and global transportation. Accordingly, such aspects should be considered when terminal development is planned (including sizing).

As is highlighted in Table 20 above, the range for integrated terminals recently constructed (considering the provision of requirements unique to each terminal planning) is 25 – 59 sqm per PHP. This clearly establishes that there is no single area norm that can fit all terminal developments.

Terminal Building Areas Key findings:

- The IMG report was prepared in September 2008 and revised in January 2009.
- The report does not consider the following factors, which are pertinent for terminal sizing:
  - Geographical location, terrain and availability of land;
  - Configuration of terminal layout;
  - Type of terminal – single, one and half or two level;
  - Structural requirements;
  - Operator being a signatory to concession agreements;
  - Requirement of enhanced operational and security requirements; and
  - Competitive positioning of the airport in the region etc.
- The norms (for integrated and international terminals) recommended by IMG are based on AAI suggestions. It is important to note that AAI had themselves undertaken construction of integrated terminals (for example, Amritsar which was commissioned in February 2009 with an area of 40,175 sqm for a peak hour passenger capacity of 1,200, resulting in 33sqm per PHP.
- A review of benchmarked airports reveals that:
  - Delhi, Mumbai and Bangalore Airports are PPP developments – governed by concession agreements.
  - Chennai and Kolkata Airports are AAI airports, not governed by any concession agreements, this provides flexibility for how the terminal planned and operated.
  - Cochin Airport is neither an AAI nor a PPP airport and therefore the airport operator has flexibility in the adoption of different operating models and in the level of service offered.
- Achieved service quality is related to cost of construction and space provided: :
  - Cochin Airport plans 12 sqm per PHP for the domestic terminal. The service level for 'overall satisfaction' at Cochin Airport is currently 3.70 as compared to an average of 4.42 for other benchmarked airports in India. The quality of construction observed at Cochin Airport is basic – below the benchmark average.
  - Kolkata Airport calculates its PHP independently for domestic and international operations and then adds them together; consequently a high PHP is shown as a combined peak resulting in the planning of a larger terminal building.
  - On a cost/sqm basis the cost of construction of Kolkata and Chennai Airports is only marginally lower than Bangalore Airport, however, service levels achieved are lower and the quality of construction is rated much below than that at Bangalore Airport.
- The terminal areas actually constructed for integrated facilities in India is in the range of 25-59 sqm per PHP.
- It is noted that each airport by virtue of the traffic handled, airlines serving the airport, route connections, position of the dominant carrier, locational advantages etc. has the potential to become a hub airport. This competitive positioning is generally recognized as a very strategic direction for the future overall development of the airport, region and the country. Accordingly, such aspects should be considered when terminal development is planned (including sizing).
- IMG norms should not be used as a planning tool because the terminal planning process is much more complex requiring calculation of space based on actual processing rates and locally defined service standards etc.

5.2.4 Recommendations of IATA for Provision of Terminal Areas

IATA is an internationally recognized body which recommends that terminal sizing be established based on service standards and locally recorded passenger process transaction times i.e. a 'bottom up' approach that calculates the required facilities and areas for each main processing function within the terminal. These will be the same service standards that appear in privatized airport concession agreements. The IATA approach to terminal sizing is set out in its Airport Development Reference Manual (ADRM).

ADRM also gives some 'top down' guidance on terminal areas. However, ADRM Edition 9 and the more recent ADRM10 do not quote any specific yardstick for integrated terminals. However, ADRM9 does suggest that "Experience has shown that, when designing facilities for purely domestic or charter passengers, the corresponding maximum sqm/PHP figure should not exceed 25 sqm and 30 sqm respectively." ADRM10 suggests that for international terminals the area per PHP should be 35 sqm.

In ADRM9, IATA recommends LoS 'C' as the minimum design objective as it denotes good service at a reasonable cost. In ADRM10, IATA has redefined the 6-point Level of Service (LoS) Framework and now refers to the ADRM9 LoS A to E more simply in a 3-point framework as Overdesign, Optimum, and Sub-Optimum. IATA now recommends 'Optimum' (equivalent to the former LoS 'C') as the ideal standard that best balances the provision of a good level of service whilst avoiding the cost of over-provision.

In ADRM9 (section C1.9.1), IATA also refers to observed terminal areas per PHP for 22 terminals in the Asia-Pacific region. The average sqm per PHP for these terminals is mentioned as 45 sqm and the median is calculated as 40sqm per PHP.

On reviewing the operations at these 22 airports (as provided in ADRM 9), it appears that 15 terminals operate as integrated facilities. The average terminal area per PHP of these 15 integrated terminals is 44 sqm and the median value is 40sqm, see Table 21 below.

Table 21: Asia-Pacific Region Integrated Airport Terminal Floor Area/Passenger Data

Airports	Country	MPPA	Floor Area (Sqm)	Sqm/MPPA	Assumed PHP	Assumed Floor Area (using 35 Sqm/PHP)	Sqm/PHP
1							
ShenYang Taoxin	China	6.1	58,000	9,508	1,525	53,375	38
Chongqing Jianbei	China	7.0	60,000	8,571	1,750	61,250	34
Manila T3	Philippines	10.0	1,50,000	15,000	2,500	87,500	60
2							
Narita T2	Japan	17.0	2,84,000	16,706	4,857	1,70,000	58
Taipei T2	Taiwan	17.0	3,08,000	18,118	4,857	1,70,000	63
Shanghai Pudong	China	20.0	2,80,000	14,000	5,714	2,00,000	49
Nagoya	Japan	20.0	2,20,000	11,000	5,714	2,00,000	39
3							
Kansai	Japan	27.0	2,93,000	10,852	9,000	3,15,000	33
Beijing Capital T2	China	27.0	3,20,000	11,852	9,000	3,15,000	36
Incheon	South Korea	27.0	4,96,000	18,370	9,000	3,15,000	55
Kuala Lumpur	Malaysia	35.0	4,80,000	13,714	11,667	4,08,333	41
Suvarnbhumi Bangkok	Thailand	45.0	5,60,000	12,444	15,000	5,25,000	37
Beijing (2010)	China	55.0	7,30,000	13,273	18,333	6,41,667	40
Beijing (2013)	China	68.0	9,00,000	13,235	22,667	7,93,333	40
Beijing (2016)	China	80.0	10,00,000	12,500	26,667	9,33,333	37
Average Figure of All Airports:				13,276			44
Median Figure of All Airports:				13,235			40

The above data has been compared with four Indian integrated terminals in Table 22 below.

Table 22: Indian Integrated Airport Terminal Floor Area/Passenger Data

Sr. No.	Airport	Terminal Floor Area (sqm)	Design Capacity (mppa)	Floor area standard per mppa	Sqm/PHP
1	Indira Gandhi International Airport (IGIA), Delhi, Terminal 3 (DOM/INT)	553,887	34	16,291	59
2	Chhatrapati Shivaji International Airport (CSIA), Mumbai, Terminal 2 (DOM/INT)	431,672	40	11,338	44
3	Netaji Subhash Chandra Bose International Airport (NSCBIA), Kolkata (DOM/INT)	198,692	20	9,934	27
4	Kempegowda International Airport, Bengaluru (DOM/INT)	161,110	20	7,931	25
	Average	341,177	29	11,373	39
	Median				36

The average for the integrated terminals at comparable Indian airports is calculated as 39 sqm per PHP, which indicates that for the same LoS 'C', the current area per PHP for integrated terminals in India is marginally lower than comparable Asia-Pacific airports.

IATA Recommendations Key findings:

- IATA is an internationally recognized body which lays down standards for terminal sizing.
- IATA ADRM is widely used internationally for determining terminal size based on service standards and waiting times.
- The approach recommended by IATA is bottom-up; requiring area calculations for each processing facility.
- IATA does not quote any specific yardstick for integrated terminals. However, it lists the current sizing for 15 integrated terminals in the Asia-Pacific region – the average of these 15 integrated terminals is 44sqm per PHP.
- IATA also provides some 'top down' guidance on terminal areas (25 sqm/PHP for domestic terminals, 30 sqm/PHP for charter terminals and 35 sqm/PHP for international terminals).
- It is noted that adoption of the IATA ADRM bottom-up approach for terminal planning would provide the necessary flexibility for airport operators to meet local conditions and service level standards defined in concession agreements, etc.

5.2.5 Conclusions

- AERA in its Consultation Paper No.5/2014-14 has quoted Prof. Anne Graham in respect of operational parameters for different airports and lists a few influencing costs, revenues and efficiency levels, stating the following:

  > *"There is no typical airport when it comes to looking at services and facilities provided. Beyond the basic operational functions, different airports have little in common."*

  It would therefore be correct to conclude that there should not be any fixed norm which can be uniformly adopted across all regions, type of airport development etc.

- In order to factor in the significant variations, the authority should consider framing a range for the terminal area norm, but this norm should act as guidance with the actual areas calculated using the IATA ADRM 'bottom up' methodology which allows level of service parameters (from AERA imposed concession agreements) and local transaction times to be factored into the sizing calculations.

- Between January 2009, when the IMG report was released and August 2014, there have been several new service level requirements and operator requirements for revenue generation which require a review of IMG norms. The 25sqm recommended by IMG in 2009, based on AAI recommendations, would therefore not be justified in the present complex operational and development scenarios. Hence, the IMG norms should not be mandated.

- Comparing the areas provided for similar terminals in the Asia-Pacific region for LoS 'C', the area per PHP for integrated terminals has been determined in the range of 33-63, with an average of 44. In the case of similar terminals in India, the range for sqm/PHP is 25 to 59.

- The setting of any limits, whether high or low will restrict an airport developer's options for the future. For example, we do not know how efficient terminal operations will become in future and how technology will change fixed infrastructure requirements. Full automation of the check-in process using internet check-in and electronic boarding cards is a distinct possibility, this would significantly impact space requirements and perversely the lower limit may in fact in the future force an airport operator to over-provide. On the other hand the higher limit may restrict an airport operator's options in the future for provision of value added services at the airport that may not be core operational requirements but which could generate revenue and perhaps offset aeronautical charges.

- It is noted that IATA standards are the globally recognized and accepted methodology for terminal sizing and should be used as the basis for determining terminal sizing.

5.3 Analysis for Establishing Range for Terminal Building Costs

The methodology adopted for the analysis for establishing a range for terminal building costs is as below:

- Evaluate the factors affecting costs of construction of terminal buildings such as year of construction, duration of the project, procurement strategy adopted, location factors, terminal facilities and design / specifications.
- Comparison of the cost of recently built terminal buildings.
- Estimate the cost for terminal building based on CPWD methodology.
- Establish a cost range for terminal buildings considering the results of the above benchmarking and analysis of CPWD.

5.3.1 Factors Affecting the Cost of Construction of Terminal Buildings

AERA in its consultation paper on 'Normative Approach to Building Blocks in Economic Regulation of Major Airports', under section Benchmarking Airports, recognizes the difficulties in airport benchmarking.

> *Airports are complex sets of businesses, and different airports operate in very different physical, financial, and governance environments. To make useful comparisons among airports, it is essential to compare similar sets of businesses operating in similar environments—which is easier said than done. When comparing one airport to another, some of the typical factors that drive different results and should be considered in making comparisons include: passenger volume, capacity constraints, mix of international and domestic traffic, mix of local and transfer passengers, mix of passenger carrier service (network, low cost, charter), mix of passenger versus cargo activity, degree of outsourcing, range of services provided by the airport, airport development program status, weather conditions, geographic location, urban versus rural location, physical size of the airport, public transportation access and usage, regulatory environment, local labour conditions, and ownership and governance structure.*

The IMG report also mentions that, construction cost is mainly driven by the target level of service standards and is dependent upon various variables.

> *The design and approach towards airport terminals has undergone a radical change. Earlier, a terminal was a building where a passenger commenced an concluded an air journey. In the present times, a lot more is expected from terminal – not only it should be functionally efficient, it should also be aesthetically and architecturally appealing. It encompasses a wide variety of activities related to aviation, leisure, comfort, shopping and business apart from customs, immigration, security, etc. Comparison with a "world class" airport in neighboring countries is also a crucial factor in planning airport terminals.*
>
> *Construction cost is mainly driven by the target level of service standards. The location is another important factor. The cost of construction generally increases by about 10% in difficult and remote areas.*

There are various factors that impact on the construction costs of airport terminal buildings. The percentage of cost that each factor contributes to the overall construction cost is not a fixed number. The cost percentage is range-based on these factors.

Table 23 below lists few prominent elements which impact on the construction costs.

Table 23: List of Factors Which Impact on Terminal Building Construction Costs

Sr. No.	Factors That Impact Construction Cost
a	Design Requirements: Building Structural Design Conditions
b	Statutory Requirements and Economic Factors
i	Exchange rate fluctuation
ii	Statutory Levies
iii	Price escalation in materials and labour due to inflation
iv	Increase in fuel prices
c	Airport Design and Facility Requirements
i	Capacity, facilities and size of the airport
ii	Terminal configurations
iii	Requirements of airlines and passengers
iv	Sourcing of materials and equipment
v	Building finishes level / specifications
vi	Selection of right and efficient combination of MEP equipments
d	Other Factors
i	Locational factors
ii	Climatic / weather conditions during construction period
iii	Time lines of the developments
iv	Presence of already operational facilities / development of brown field airports
v	Increase in cost due to new regulations / guidelines from various Government Authorities

a) Design Requirements: Building Structural Design Conditions

Many parameters affect the construction design. Not only does a building need to be appealing to the eye, it has to be structurally sound. Wind loads, high water areas, seismic zones, coastal regions, cyclone prone zones, soil conditions / soil bearing capacity, loading capacities etc. all impact on the design. The type of construction such as structural steel or RCC framed conventional building is a major factor affecting the overall construction cost. All types of construction design will differ based on the material or combination of materials used. Other important factors are the building code guidelines and fire safety guidelines in effect in a particular area. As a result the percentage of cost for the sub-structure and the super-structural frame typically ranges between 9% to 12%.

b) Statutory Requirements and Economic Factors

i. Exchange rate fluctuation

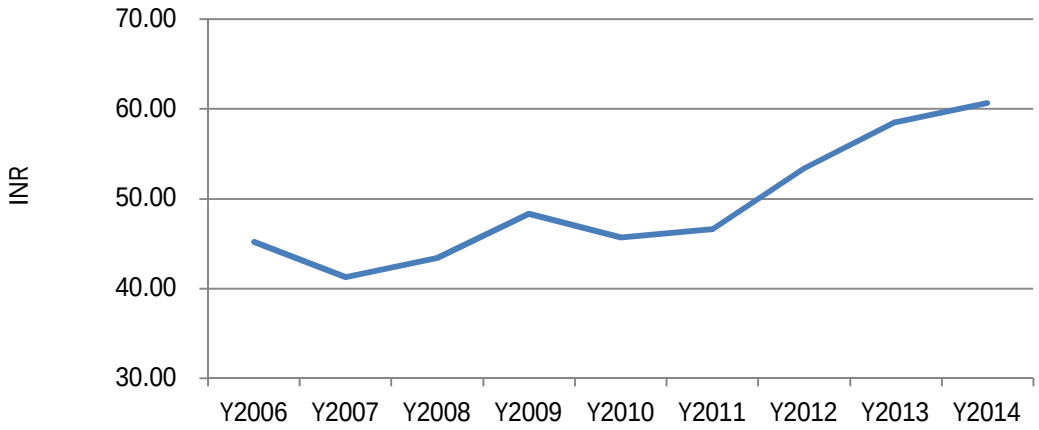
The depreciation of the Indian Rupee against the US Dollar for the past 9 years is shown in Table 24 below. The Indian Rupee began to weaken substantially against the US Dollar from 2006 and since that time its value has reduced by 34%.

Table 24: Exchange Rate Fluctuation USD vs. INR

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
USD Vs INR	45.22	41.25	43.44	48.34	45.68	46.61	53.38	58.52	60.66

Figure 22 below indicates the historical movement of the foreign exchange rate for the INR against the USD for the last nine years. This fluctuation has a significant effect on the cost of materials imported for the construction of terminal buildings. Considering that the cost of import materials for the terminal building development is between 20% to 25% of the total cost, the impact on the overall terminal building development cost due to the exchange rate fluctuation was approximately 6% to 7.5% for the 4-year period from 2011 to 2014 (during which the Indian Rupee depreciated by approximately 30%).

Figure 22: USD vs. INR Movement Graph



The key factors that are likely to impact on the Indian Rupee depreciation in the near term are political stability, stability of economic policies, inflation and interest rates, foreign portfolio flows, oil prices and fiscal deficit.

ii. Statutory levies

Taxes in India are levied by the Central Government and the State Governments. Some minor taxes are also levied by the local authorities such as the Municipality and Corporations. The Union government collects Excise Duty, Customs Duty and Service Tax. The State

Governments collect Sales Tax (VAT). The rates of taxation undergo changes during Union and State Government budgets causing the prices to fluctuate during the period of construction. Besides this, the differences in rates adopted between State Governments and tax related policies, cause differences between the cost of development of terminal buildings in different states. The total cost percentage impact due to this factor for a period of four years during the terminal building development is approximately 2% to 6%.

Mumbai is subject to an additional burden of the Octroi ranging from 5.5% to 7% and similarly Bangalore is subject to entry tax. Furthermore, for cities like Mumbai the incidence of local body taxes as well as the State Taxes are among the highest in the country and also all other expenses like warehousing, labour, logistics, space constraints affect all aspects of business. This significantly increases the cost of construction at this location. The VAT rates during the construction period of the benchmark terminal buildings at the respective states range between 12.5% and 14.5%.

iii. Price escalation in materials and labour due to inflation

Construction cost inflation in India picked up considerably in the last decade and is a major issue for project procurement in India. Construction inflation rose to 8 per cent in 2012, mainly due to rising labour and material costs. Given the growth forecast for the Indian construction sector and pressure on wages due to higher general inflation, construction cost inflation is likely to stay high. Construction cost inflation in various Indian cities from year 2010 is observed to be between 6 to 8%. This inflation affects the cost of construction significantly and hence the terminal building developments completed at different periods are not comparable for construction costs since inflation impacts the final construction cost. Figure 23 and Figure 24 below indicate the movement of the local labour price indices and Wholesale Price Index (WPI) respectively for various cities.

Figure 23: Labour Price Indices Graph

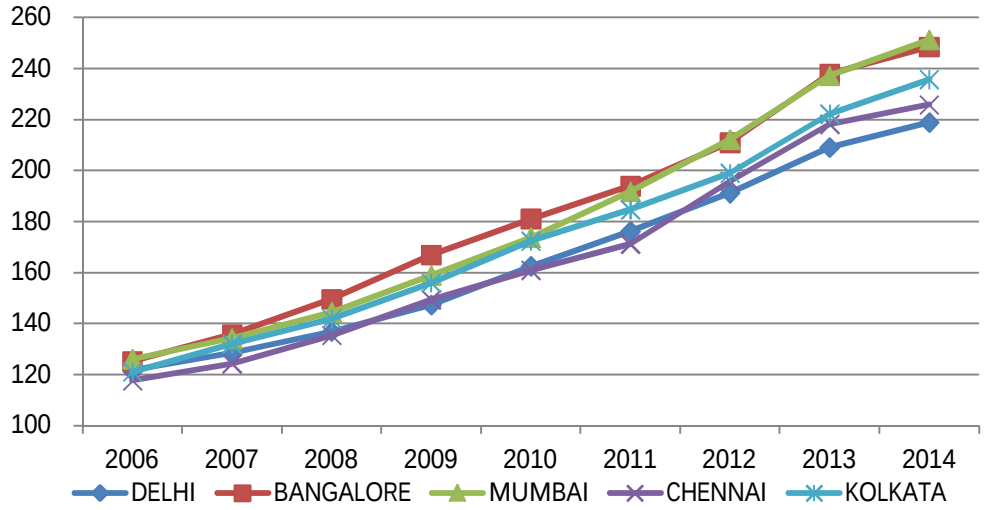
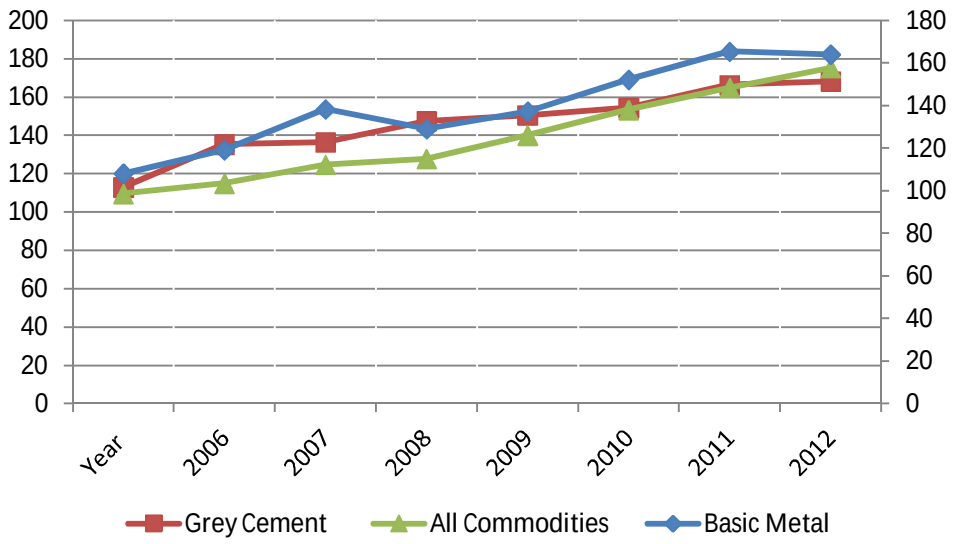


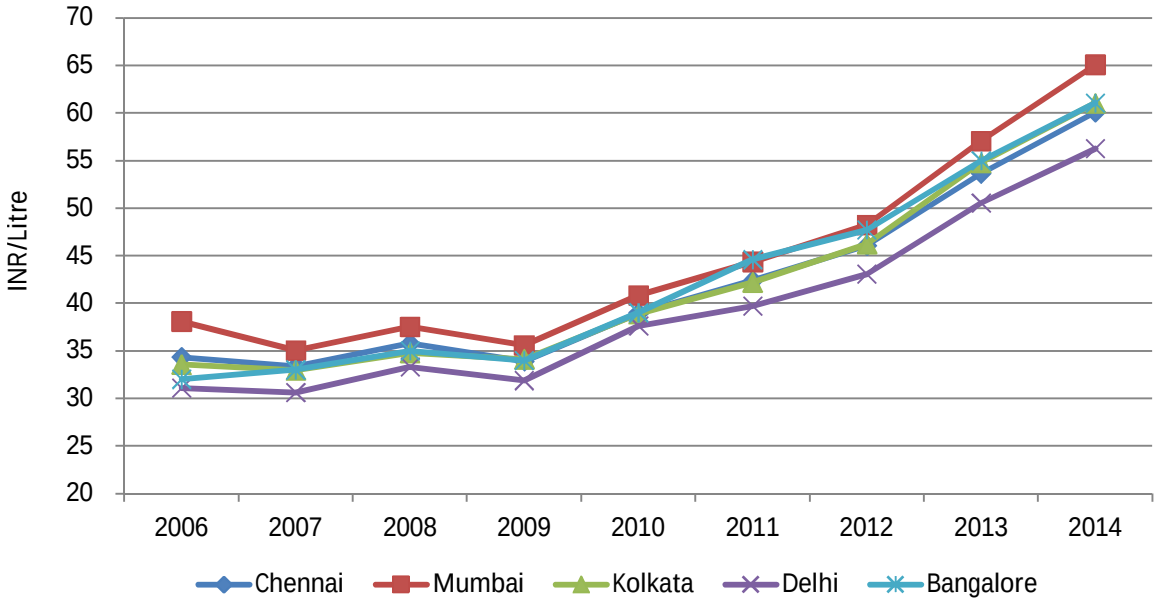
Figure 24 – WPI Price Indices Graph



iv. Increase in fuel prices

The fuel price in India is highly unstable. Fluctuations in fuel prices have affected the cost of construction significantly. The historical diesel price in India since the year 2006 is indicated in Figure 25 below. It is evident from the figure that the cost of fuel at different locations in India has increased by between 71% and 90% over the last decade. Due to local subsidies the rates of fuel (diesel and petrol) change significantly among different states / cities.

Figure 25 - Diesel Price Historical Price Chart



c) Airport Design and Facility Requirements

i. Introduction

In this section we consider the issues related to the varying physical extent (size) of terminal buildings as well as the varying specifications and complexities of the buildings.

ii. Capacity, facilities and size of the airport

The different functions of buildings (e.g. domestic, international, integrated) require different configurations, processing areas and extent and complexity of equipment and also are often built to differing standards reflecting different market conditions. Therefore it is not a straightforward exercise to benchmark and compare the cost per sqm of construction between the various airport terminal facilities. The proportion of the total cost used for facilities and equipment in terminal buildings typically ranges between 6% and 10%. The facilities and equipment assessed include the following:

- Check-in facility - Counters for Domestic & International
- Conveyor belts at arrivals for Domestic & International
- Aerobridges
- Equipment
    - Baggage Handling System
    - Scanners/Material screeners/Metal detectors
    - Other Equipment such as Elevators, Travellators, Escalators
    - Chiller, DGs, Transformers
- Additional requirements – which include demonstrable energy efficiency (with LEED Certification), baggage handlings systems incorporating baggage reconciliation systems and sorting systems, and space for secondary services and systems.
- Multiple use of facilities - Usage of CUSS counters along with traditional check-in counters, CCTV surveillance systems, Airport Operations Control Centers, transfer facilities, day hotels or sleeping pods, kids play areas, food courts etc.

Each of the above mentioned airport systems, equipments and facilities has direct impact on cost depending upon the capacity, size and facility requirements of any particular terminal building; as such it is very difficult to set one single benchmark cost of such facilities for all terminals.

iii. Terminal configurations

The terminal configuration (integrated terminal or non-Integrated terminal) significantly affects the cost per sqm of the terminal building development. The incorporation of swing facilities for both domestic and International use within a truly integrated airport terminal increases the efficiency of the facility so that it can handle more passengers per given area.

The terminal mode of operation such as Domestic requires fewer facilities (e.g. no immigration facilities) so less space is required and hence costs can be reduced when cost is measured on a passenger throughput basis, International operations on the other hand require more facilities and generally cater for longer dwell times of passengers. As such

International terminals need more facilities, more space and subsequently more cost (when cost is measured on a passenger throughput basis).

Common use or Integrated terminals which have a mix mode of operations (Domestic & International) need more complex arrangements for the provision of additional transfer facilities for domestic to International and vice versa transfer operations. These facilities require more space and also more cost (when cost is measured on a passenger throughput basis).

iv. Requirements of airlines and passengers

The types of flights and airlines served will determine many of the principal design features of a terminal, including airport-wide services, baggage handling, IT systems, gate design and retail requirements etc. Terminals dealing primarily with low cost or regional passengers may, for example, have different facility requirements and different demands for check-in desks, baggage handling systems, gates or aerobridges.

v. Sourcing of materials and equipment

The sourcing of the materials and equipment for the construction of the airport terminal buildings considerably impacts the cost of construction. There cannot be a single defined measure, as this would depend on the material, its volume and the source.

As per discussions at Kolkata Airport, AAI has placed a bulk order with Bukaka to supply aerobridges which has resulted in a cost advantage to AAI due to procurement economies of scale. Private operators of individual airports do not get this cost advantage due to the placing of single orders with fewer aerobridges for example. This can be a reason for higher overall cost of construction of the terminal buildings of the private developers.

vi. Building finishes level / specifications

A wide range of finishes and material specifications exist for the choice of construction and fit-out of the terminal building. The choice of materials, finishes and specifications will impact on the overall cost of construction. The foundation of the building may be constructed using pilings or footings as per the local soil conditions and the structural design for stability will therefore vary. Similarly the flooring may be granite, marble or vitrified tile which results in different costs. A wide range of options are available for wall and ceiling finishes as well.

vii. Selection of right and efficient combination of MEP equipments

The selection of chillers, DGs, transformers, light fixtures, CP & sanitary fixtures significantly impacts on the overall cost of construction due to cost differences between the various products.

Some of the capex is discretionary but there may be a trade-off with lower OPEX e.g. LED lighting, lighting control system, automation, efficient chillers and transformers etc. The degree of automation, integration of systems, complexity of systems will vary according to the size of airport and therefore these impacts on the cost of equipment such as VHT, HVAC etc.

Building components that use significantly less energy or have a higher life expectancy may well result in lower total costs for users to bear, when compared to products which are initially lower cost. Life-cycle cost studies are essential to compare the initial costs, and the repair, maintenance and replacement costs of alternative specifications. Specification of components with shorter life-spans, such as services and finishes, must be carefully considered, not only in terms of cost effectiveness but also to reduce maintenance that might obstruct airport operations.

With operations and maintenance (O&M) costs being one of the largest elements in every airport's budget, it is critical to consider the long-term implications of making short-term cost reduction decisions.

Predominant construction elements and their approximate cost range as a percentage of the overall terminal building development cost are set out below:

- Structural Works
  - Foundation for the terminal building (4% – 6%)
  - Superstructure (25% – 30%)
  - Type of column - RCC or Structural steel (8% – 10%)
  - Height of structure (2% – 4%)
- Architectural Works
  - External & internal Wall & partitions (3% – 6%)
  - Wall, floor and ceiling finishes (4% – 8%)
- External façade works (2% – 3%)
- Services
  - Electrical works (8% - 12%)
  - HVAC (9% - 11%)
  - PHE & Fire Fighting (3% - 5%)
  - FIDS, EPABX, CCTV & Access Control systems (2% – 5%)
- Equipment
  - Aerobridges, baggage handling systems (6% to 10%)

d) Other Factors

i. Locational factors

The airport locational factors contribute to the construction costs particularly for preliminaries and general costs associated with construction contracts. This section provides an outline of possible locational cost factors that impact on terminal building capital expenditure; these factors include the following:

- Access to the main city;
- Infrastructure connectivity during construction;
- Logistics in bringing materials to the construction site; and
- Mobilizing machinery and construction equipment.

Other than the above, the complex operations found particularly when working in restricted airside zones create a wide range of additional cost drivers.

The airport specific requirements that can affect the terminal building design, construction and eventually the total outturn cost include the following:

- Requirements of stakeholders, including the Department of Transport, Customs and Special Branch;
- Aviation Authority restrictions on permanent building heights within aerodrome safeguarded surfaces;
- Enhanced acoustic control and monitoring measures; and
- Cost of general and preliminary requirements.

ii. Climatic / weather conditions during construction period

Adverse weather conditions will affect the progress of construction projects. Additional time and costs can be expended due to delays caused by adverse climatic conditions during the course of construction. For example in Mumbai during the monsoon for a period of almost 3-4 months efficient construction progress is hampered due to heavy rain conditions

iii. Time lines of the developments

Over the last few years, the cost of construction materials has been rising, this trend will continue in future.

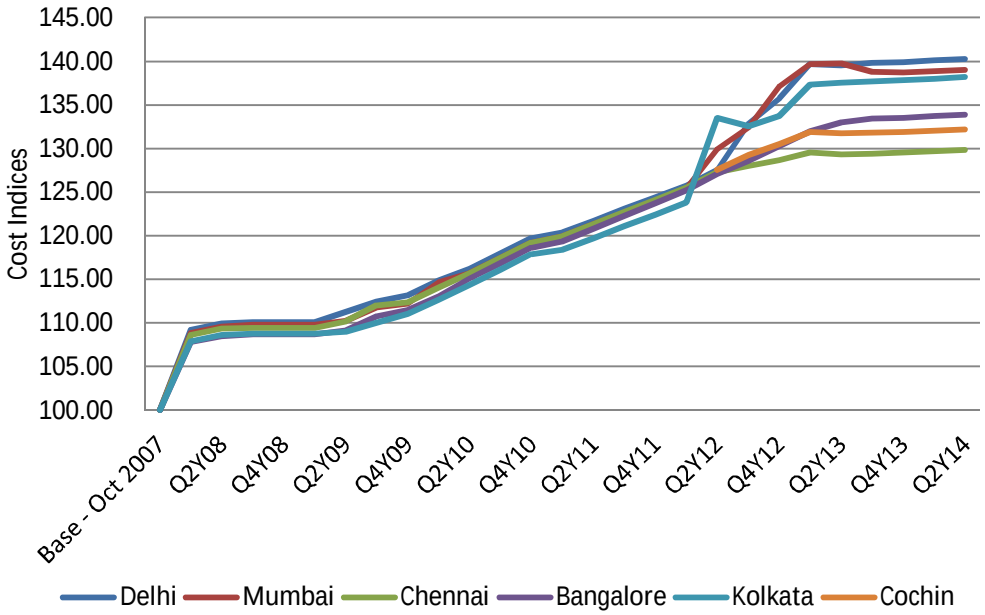
It may sound obvious, but in such a tough operating environment, understanding the impact of the rising cost of construction materials / equipment is a critical factor in delivering successful airport terminal projects. In addition, the overall duration of large airport capital programmes (often lasting five or more years after initial concept development until beneficial operation) further exposes these projects to the impacts of rising construction material costs.

The global economy and ever-changing business models of the airlines also compound already intense cost pressures associated with such large-scale capital projects.

The Construction Industry Development Council (CIDC) has been publishing Construction Cost Indices since 1998. Construction Cost Indices monitor variations in the overall cost of construction for various types of projects such as buildings, roads, bridges, railway construction, dams, power plants, industrial structures, urban infrastructure including factories etc.

Figure 26 below indicates the movement of prices in urban development projects at various locations in India as published by the CIDC:

Figure 26: Construction Cost Indices



Construction cost inflation in India picked up considerably in 2012 and is a major issue for project procurement in India. Construction inflation rose to 8 per cent in 2012, mainly due to rising labour costs and higher costs of imported materials. Given the growth forecast for the Indian construction sector and pressure on wages due to higher general inflation, construction cost inflation is likely to stay high.

iv. Presence of already operational facilities / development of brown-field airports

Development of facilities in a live airport operational environment often leads to cramped and constrained sites and limitations on access with costs rising accordingly on account of the following factors:

- out-of-hours working and phased development to minimize disruption to passengers and aircraft;
- controls on delivery and construction traffic to prevent airport road congestion;
- costs associated with airside/landside security;
- training costs to obtain driving and works permits;
- maintenance of airside fencing;
- control of dust and debris to avoid ingestion by aircraft engines;
- vibration limits when working close to sensitive equipment;
- lack of space for storage and parking and labour colony;
- administration of security within restricted areas;
- below-ground services and;
- Additional safety/signage/hazard identification measures.

In a brown-field project like Mumbai Airport's T-2 and Bangalore T-1 upgradation, the cost for maintaining continuity in ongoing operations increases construction costs compared to a green-field construction. Therefore setting a single benchmark costs for all terminal construction works at both green-field and brown-field sites is not appropriate.

The availability or unavailability of space for a labour camp and on-site fabrication affects the construction cost. In the case of Mumbai Airport, there was limited availability of space for storage of construction materials and for provision of a labour camp close to the work site. So, Mumbai airport was forced to store the materials at warehouses at a distant location. Additional cost was therefore incurred for such warehousing, labour accommodation and transportation of materials and labour back to the site, which may not be the case with green-field airports.

Furthermore, due to space constraints at operational airports, changes in construction methodology different from a more conventional methodology may require additional scaffolding, the use of heavy cranes for longer periods of time and other resources which impact on the overall cost of terminal development.

v. Increase in cost due to new regulations / guidelines from various Government Authorities

Cost is also subject to variations due to change in codes, laws, new directives etc. from airport authorities, ICAO, DGCA, BCAS, Home Ministry, Aviation Ministry and other applicable authorities.

Key findings:

- As detailed above, there are many variable factors that impact on terminal building development costs from one airport to other. This variation is demonstrated numerically in the following section for the recently built 4 major airports.
- Therefore, there it is not advisable to fix a ceiling cost or a 'normative cost' of development of INR 65,000 per sqm as proposed by Authority for all airports without having any regard to this wide range of variables that impact on the overall costs of construction.

5.3.2 Comparison of Costs of Recently Constructed Terminal Buildings

As explained above, essentially the cost of construction of an airport terminal, to a large extent, is based on the operational requirements and the design specification of the terminal. It is possible to obtain an actual indicative cost range by comparing the recently built major airports terminals in India at Chennai, Kolkata, Mumbai, Delhi and Bangalore. Variations in the costs are attributable to the various parameters as elaborated above.

For the purposes of establishing a 'like-for-like' comparison, corrected cost and area data has been considered and presented in the earlier Table 9.

Furthermore, as the construction of the benchmarked terminals have been undertaken/proposed at different time periods, the costs have been indexed to the current period (June 2014), so as to enable a fair comparison of these costs. The indexed costs are summarised in Table 26 below.

The Cost Indices related to the Mumbai, Delhi, Bangalore, Chennai and Kolkata Airport development periods under 'Urban Infra' have been sourced from The Construction Industry

Development Council - CIDC website for analysis. The cost indices are available for various locations / cities on a monthly basis.

The following Table 25 indicates the completion periods of the above mentioned airport projects.

Table 25: Completion Periods of Airport Developments

Airports	Mumbai	Delhi	Bangalore	Chennai	Kolkata
Year of completion	Feb'14- (Int) / June'15 (Dom)	Jul'10	Dec'13	Sep'12	Aug'12

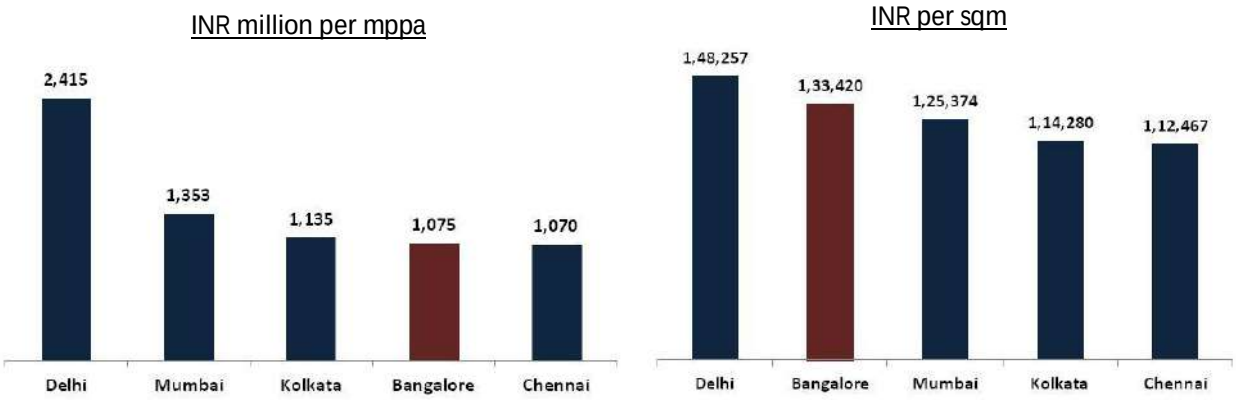
Since the completion period of these airports is different, it is necessary to compare the costs at the current period by applying the necessary cost indices for fair comparison (refer Section 3 earlier):

Table 26: Summary of Completion and Indexed Costs for Recently Constructed Terminal Buildings

Particulars	Unit	Delhi	Mumbai	Bangalore	Kolkata	Chennai
Terminal compared		T-3	T-2	Upgraded T-1	New Terminal	New Terminal
Terminal Building Area	Sqm	553,887	431,672	161,110	198,692	133,142
Terminal Capacity	Mppa	34	40	20	20	14
Total completed cost	INR million	68,360	54,000	19,454	21,546	14,765
Indexed Cost (June 2014)	INR million	82,117	54,120	21,495	22,706	14,974
Indexed cost/Sqm	INR per sqm	148,257	125,374	133,420	114,280	112,467
Indexed Range for Terminal Building cost	INR per sqm	112,467 – 148,257				
Indexed cost/mppa	INR mn per mppa	2,415	1,353	1,075	1,135	1,070
Indexed Range for Terminal Building cost	INR mn per mppa	1,070 – 2,415				

Note: Refer to Table 10 for total area and cost for Bangalore upgraded T-1 and also cost indexation percentages applied for all benchmark airport terminals.

Figure 27: Comparison of Indexed Terminal Development Cost



It is evident from Figure 27 that the construction costs of recently built major terminal buildings in India (built by AAI and also through PPPs) typically range between INR 112,000 to INR 148,000 per sqm (normalized costs rebased to June 2014), which is much higher than the ceiling norm cost of INR 65,000 per sqm as proposed by AERA.

Kolkata and Chennai Airports are not bound by any concession agreements requiring them to comply with additional service levels/quality of construction etc., apart from AAI's own standards and requirements. Even so, the terminals at Kolkata and Chennai Airports are developed at a much higher cost level than the norm proposed by AERA (INR 65,000 per sqm).

It can also be seen from the Table 26 that the indexed cost per sqm for the integrated terminals developed under PPP arrangements at Delhi, Mumbai and Bangalore Airports are relatively high as compared to the costs for other benchmarked airport terminals. It would be appropriate to mention here that the PPP airports are governed by concession agreements which generally stipulate strict service levels to be followed and provision for high quality service at these airports.

In addition, Bangalore and Mumbai Airport terminals were brown-field developments requiring redevelopment/expansion of terminal facilities at operational sites. This imposes major complexities in the planning and execution of these development projects including the need to undertake enabling works. Such complexities and enabling works result in a higher cost of development due to restrictions on the movement of goods and people, the need to provide for alternate processing facilities, time restrictions and the need for multiple handling, etc.

As can be seen in Figure 27 above, amongst the benchmarked terminals, Bangalore is ranked 2nd in cost per sqm, however, it is ranked 4th in cost per mppa between Kolkata and Chennai Airports indicating that the Bangalore Airport passenger terminal infrastructure is relatively well utilized.

As development costs vary due to the timing of construction, physical location, customer base and many other factors, as mentioned above, setting a single index such as cost per sqm as a maximum development cost (especially when the ceiling value of that index is at what is considered to be a very low level) will impose severe constraints on airport developers and, at the level suggested by AERA, will result in a degradation of perceived quality.

In this report, we have assessed terminal construction cost effectiveness through a cost per mppa measure. ICAO also uses productivity/efficiency as a key 'Performance Indicator' for airports performance. As per ICAO, cost effectiveness refers to the financial input or costs required to produce a non-financial output i.e. total cost per passengers. AERA should thus evaluate airports for their productivity and cost effectiveness and incentivize efficiency.

The evaluation by this measure demonstrates that there are alternative ways to assess cost. As discussed in section 3 of this report, there is a significant cost variation amongst the various benchmarked airports on a per sqm basis, the cost per mppa is generally uniform except in the case of Delhi Airport. Thus, significant variation in the results obtained from cost per sqm and cost per mppa, clearly indicates that there is 'no single parameter' which is complete in itself for comparing two different terminals.

In this context, it is to be noted that the tariff determination process also considers *annual passenger throughput* for determining the applicable development fee. Also, ICAO, by its cost effectiveness measure, emphasizes on terminal cost productivity considering *annual passenger throughput criteria.*

Thus, the Authority should not establish standards on cost per sqm norm only; other relevant and internationally accepted parameters such as cost per mppa, which relate more to productivity and asset utilization and the 'value for money' of the terminal development cost, should also be considered.

Key findings:

- The costs of development of terminal building are governed by wide range of factors and because of this there can be no single fixed target cost level that is appropriate for all airports.
- It might be more appropriate to establish a cost range for airport developers to work within as long as this cost range reflects the myriad of factors that influence airport terminal development capital costs. AERA's proposed ceiling cost of INR 65,000 per sqm is much lower than the cost per sqm of benchmarked airports which typically range between INR 112,000 to INR 148,000 (normalized cost rebased to June 2014).
- The costs of development of terminal buildings for PPP airports are governed by unique factors as compared to AAI/other private airports:
    - Concession Agreements stipulating strict service levels and requirements for enhanced quality of construction.
    - No cost advantages from bulk procurement of high-value items across multiple locations.
- Authority should not establish standards on cost per sqm norm only; other relevant and internationally accepted parameters such as cost per mppa, which relate more to productivity and asset utilization and the 'value for money' of the terminal development cost, should also be considered.

5.3.3 Analysis of Airport Terminal Building Costs Using CPWD Cost Standards

The Central Public Works Department (CPWD) has published Plinth Area Rates (PAR) edition 01.10.2012 for buildings such as offices, colleges, hospitals, schools and hostels. The CPWD has stated that the use of this published document shall be for Central Government Departments, Public Sector Undertakings and the Private Sector.

The rates adopted in the PAR are based on a detailed analysis of the actual cost of construction of buildings of various types in different parts of the country and provide a realistic basis for assessment of the approximate cost of newly proposed buildings.

As there is no direct reference to airport terminal buildings in the document an attempt has been made to evaluate a standard building with the prescribed PAR and develop that for a terminal building with appropriate factors to arrive at a cost per sqm. For elements that are not covered in the simple buildings, reasonable assumptions have been made and market rates have been applied to arrive at an indicative cost per sqm for an airport terminal.

As per PAR 2012, the following are the exclusions from the building cost assessment (the same have been added separately in the CPWD analysis in Table 28 below):

- The PAR rates are to be applied to normal conditions and normal layout plans. If any extras are required due to the nature of the layout involving filling, cutting or bringing services in from a large distance, then additional provisions shall be made.

- The cost of bulk services, water supply, sewage disposal etc. (which includes pumps, extension of lines from sources of local bodies, sewage treatment plants and sewage pumps etc). Extra provision is required depending upon site conditions.

- The cost of HT sub-station equipment, LT distribution system, DG sets, pumps, air conditioning, AC plant and other specialized works such as aesthetic external lighting with metal halide lamps and façade lighting, addressable fire alarm system, rising mains, UPS, aviation obstruction lighting, storage water coolers, IBMS, CCTV, access control systems for security etc. are taken as actual based on the functional / utility of the proposed building.

In addition to above PAR excluded costs, the following costs are also required to be considered for the construction of an airport terminal building (the same have been added in the CPWD analysis in Table 28 below):

- 100% back up provision for DG set, UPS
- Airports Systems such as PBBs, VDGS, BHS, VHT, security screening equipment;
- IT systems related to airport operations;
- Extra costs for steel structure works (for larger spans / roofs), special external enclosure/ façade systems, membrane roofing, use of higher specification for Interior works to be on par with international standards; and
- Special works such as airport seating, mill works / counters signage, landscaping etc.

The following Table 27 illustrates the difference in specifications being followed in public buildings such as offices, colleges, hospitals, schools and hostels as per CPWD and the specifications followed in recently completed airport terminal buildings for some of the major cost items.

Table 27: Illustration of Differences in Specifications for Commercial Buildings (as per CPWD) and Airport Terminals

Item Descriptions	CPWD - Offices / Hospitals / Schools	Terminal Building
Foundations	❖ based on soil investigation	✈ Piling with pile caps foundation. ✈ Pile depth upto 12 mtr ✈ Depth of Pile Cap upto 1.50 m below GL
Superstructure	❖ RCC Framed Structure with filler wall in fly ash brick work. ❖ Internal partitions in light weight concrete / gypsum blocks	✈ RCC / Steel composite structure with filler walls in block masonry. ✈ Internal partitions in concrete block masonry / glass partitions ✈ SS wall / column guards
Doors & Windows	❖ Framed 2nd Class TW / anodized power coated Al framework. ❖ Paneled Shutters with 2nd Class TW Flush Door with teak veneer ply as CPWD specification ❖ Windows- powder coated Z section Aluminum frames and shutters	✈ MS Metal Frame ✈ Fire Rated Hollow Metal Shutters, Glass Doors with provision for Access Control system. ✈ Panic Bar ✈ ACP cladding & Curtain glazing
Flooring	❖ Main Entrance - Polish granite ❖ Corridors - vitrified / granite ❖ Rooms - granite/vitrified/ceramic ❖ Basement - vacuum dewatered concrete ❖ Rest Area - Kota Stone	✈ All public area - granite flooring with screed, which is @ 70% of flooring area ✈ Non- Public - Vitrified / kota (with screed) which is @ only 15% of the flooring area ✈ Additionally, @ 15% is covered with carpet flooring (with screed) ✈ Self Leveling Epoxy Floor
Skirting	❖ As per Room	✈ SS Skirting /column guards
Staircase-Internal	❖ Granite / marble flooring in tread & risers	✈ Granite Flooring in tread / risers
Staircase-Fire Exit	❖ Kota flooring in tread & risers	✈ Kota flooring in tread & risers
Staircase-Railing	❖ SS railing	✈ Glass Partition with SS railing
Toilets	❖ Granite Flooring ❖ Glazed tiles in dado ❖ Granite counter ❖ SS sink ❖ Mirror with modular PVC frame	✈ Granite Flooring ✈ Corian material counter ✈ Mirror with backing / studs ✈ Cubical partitions
Roofing	❖ RCC roofing with brickbat waterproofing treatment ❖ Over Decking insulation	✈ Steel Structure roof with metal roofing with insulation
False Ceiling	NA	✈ Metal / GFRG / GFRC Ceiling, Gypsum False Ceiling
Finishing-External	❖ Dry stone cladding ❖ Washed grit plaster / weather coat paint ❖ Structural glazing & ACP cladding	✈ Dry stone cladding ✈ Structural glazing & ACP cladding ✈ Glass Curtain walls / Cable walls

Finishing-Internal	❖ Gypsum Plaster in dry areas ❖ Cement Plaster in wet areas ❖ Dry distemper in service areas / basement ❖ OBD, Acrylic / Emulsion / Texture Paint	✈ Metal / decorative Paneling ✈ Corian Cladding / Stone Cladding ✈ SS / ACP cladding ✈ Acrylic / Plastic Emulsion Paint

The cost per sqm based on the Work Trades covered under CPWD items and the Work Trades which are selective for Airports (not covered under CPWD trades) sums upto just over INR 1,49,000 per sqm. Details of the cost break down are given in Table 28 below.

Table 28: Estimate of Terminal Building Cost Using CPWD Cost Standards

S. No.	Description	Cost Per Sqm (INR)	CPWD Par 01.10.2012 Ref. No.
	Items as per CPWD Plinth Area rates (S. No. A & B)		
A	Civil and Structural works		
1	RCC -Framed Structure- Floor Height 3.35 m	23,500	1.1.1 (A)
2	Every additional Storey over six storey upto Nine Storey (3 Storey)	1,680	1.2.1
3	Every 0.30 mt additional height of floor above normal floor height of 3.35 mt (18 additional heights)	4,860	1.2.3
4	Pile foundations upto to a depth of 15m (On ground floor area only)	2,938	1.2.10
5	Resisting Earthquake Forces	1,140	1.2.8
6	Stronger structural members to take heavy loads above 500 kg per sqm upto 1000 kg per sqm	1,500	1.2.11
7	Larger Module over 35 sqm	1,500	1.2.12
8	Basement Floor (floor ht. 3.35 m with normal water proofing)	2,850	1.3.1 (Assuming 15% of the total area)
9	Extra for Basement with Every 0.3mt additional height (above 3.35 mt)	2,320	1.3.2.1
	Sub-total	42,288	(A)
B	Services		
1	Additional for internal water supply & sanitary installation	4,229	10% of A (CPWD Ref. No. 3.1)
2	Add for External & Internal Service Connections	2,114	5% of A (CPWD Ref. No. 3.2)
3	Add for internal electrical installation	6,343	15% of A (CPWD Ref. No. 3.5)
4	Extra for power wiring, central call bell system lightening conductors, telephone conduits, quality assurance etc.	2,749	6.5% of A (CPWD Ref. No. 3.6)
5	Fire Fighting	750	(CPWD Ref. No. 2.9.2)
6	Fire Alarm	500	(CPWD Ref. No. 2.10.2)
7	Development of Site		

a	- Leveling	95	(CPWD Ref. No. 6.1)
b	- Internal Roads & Paths	145	(CPWD Ref. No. 6.2)
c	- Sewer	110	(CPWD Ref. No. 6.3)
	Sub-total	17,035	
A+B	Total As per Work Trades covered under CPWD	59,322	
	Add for cost index at Bangalore (10%) (110-100)	5,932	Cost index Base 100- As on June 2014 cost index -110
C	Total	65,255	
D	Non CPWD Items required for Terminal Building		
1	Extra for Utility Building Structure, DG set required for 100% backup, AC plant, cooling tower, HT Substation, etc.	1,855	Refer note no 4 CPWD PAR 2012
2	Underground Structures (UG Tanks, Service ducts and Pump house)	410	Refer note no 3 CPWD PAR 2012
3	Provision for Heavy filling, cutting and carriage of materials	600	Refer note no 2 CPWD PAR 2012
4	HVAC Works	3,180	As per BIAL Expansion Project
5	VHT	3,860	As per BIAL Expansion Project
6	Passenger Boarding Bridges	2,400	As per BIAL Expansion Project
7	BHS with Security System	7,850	As per BIAL Expansion Project
8	Special Construction - Airport seating, Signages, Mill Work, Landscaping, Water Features, Airport Furnishes, Art Works, etc.	4,400	As per BIAL Expansion Project
9	STP & WTP Works (EM)	325	As per rate analysis
10	IT System	5,800	As per BIAL Expansion Project
11	Extra for higher specification interior works for terminal building	10,572	Assuming @ 25% of 'A'
12	Extra for Façade Works	7,884	As per rate analysis
13	Extra for metal roofing including C Steel Structure	12,442	As per rate analysis
	Total For Non CPWD Items	61,578	
C+D	Grand Total (CPWD & Non CPWD items)	1,26,833	
	Architectural & Structural Design Drawing	6,976	5.5% of (A+B) as per Architectural Council of India
	Planning & Construction Management	11,415	(4% + 5%) % of (A+B) (CPWD Work Manual 2012)
	Contingencies	3,805	3% of (A+B) (CPWD Work Manual 2012)
	Grand Total (CPWD & Non CPWD items)	1,49,028	

Note: Cost details "As per BIAL expansion project" provided by BIAL.

This analysis clearly shows that the ceiling cost proposed by Authority of INR 65,000 per sqm for an airport terminal building is much lower than the cost derived on the basis of CPWD norms.

5.3.4 Conclusions

The factors discussed in detail in sections 5.3.1, 5.3.2 and 5.3.3 demonstrate quite clearly that fixing a particular cost per sqm as a maximum construction cost for every airport terminal building is not rational.

- Airport facilities can reasonably vary in specification and price for a number of compelling reasons including traffic type, degree of peaking, facility specifications, the needs of users, and local costs and conditions etc. and no one terminal building can be identical / similar to other terminal building. There is a wide range of such issues influencing the cost of an airport terminal, most of which may account for legitimate differences between the built costs of terminals across India. It does not appear that AERA had actually accounted for such factors while fixing the norm cost of INR 65,000 per sqm.

- The indexed construction costs expended for all the recently developed major airports in India shows that construction costs vary from airport to airport due to various factors as elaborated above and are in a range of INR 112,000 to INR 148,000 per sqm, significantly above the INR 65,000 per sqm norm suggested by AERA.

- Terminal costs can also be looked at differently from a different perspective such as cost per mppa which gives an indication of how efficiently the terminal building asset is being utilized. This is also commensurate with the tariff determination process as it considers *annual passenger throughput* for determining the applicable development fee. ICAO also, by its cost effectiveness measure, emphasizes on terminal cost productivity considering *annual passenger throughput* criteria.

- An attempt has also been made to estimate airport terminal costs using the CPWD methodology. However, it should be noted that the CPWD methodology does not specify airport terminals as a specific construction category. Nevertheless, using this methodology, we observe that the likely cost of an airport terminal, with specific airport related costs added in, would be approximately INR 149,000 per sqm, which is much higher than the ceiling cost proposed by authority.

Furthermore, as explained above, essentially the cost of construction of an airport terminal, to a large extent, is based on the planning requirements and design specification of the terminal. So unless planning and design norms, specifications, customer requirements and operational service standards, followed for works and various airport systems of constructed terminals are compared and understood in the context of each of their specific physical and functional requirements, just comparing the cost would not help to understand the reasons for variances in the costs of the terminals. Also, for the future, unless terminal planning and design norms are standardized in the Indian context, pre-empting the cost of a terminal (such as applying a cost per sqm norm) cannot be achieved. Therefore, any 'one-size fits all' approach is not appropriate for the terminal building costs; larger terminals often require more complex facilities leading to higher CAPEX. A range of other factors mean that what is cost effective at one terminal may not be at another.

Section 6

Factors Affecting Airfield Pavement (Runway/Taxiway/Apron) Design and Cost

6 FACTORS AFFECTING AIRFIELD PAVEMENT (RUNWAY / TAXIWAY / APRON) DESIGN AND COST

AERA in its Consultation Paper No. 5/2014-15, Proposal No. 5 – 'Norms of Capital Costs' has proposed ceiling cost for airfield pavement as below:

> *The Authority proposes to consider capital costs of Runway/Taxiway/Apron at a ceiling cost of Rs. 7,000 per sqm or actual whichever is lower (excluding earthwork up to sub-grade level). The expenditure of the earthwork will be carried out as per the CPWD methodology.*

6.1 Parameters Affecting Airfield Pavement Cost

The cost of an airfield pavement is dependent on various parameters, some of which are described below:

A) Type of Airport Development

At a green-field airport, development works are not subject to operational restrictions on the construction activities. However, at operational airports, for development works, only a limited time period (working window) is usually made available for the execution of works based on airport operational requirements. This demands additional equipment, manpower and other resources incurring additional costs and making the construction activity less efficient.

In an operational airport work environment, it is necessary to carry out enabling works (such as fencing, temporary ramps, road diversions, temporary signage, rerouting of existing electrical / communication cables etc) to facilitate smooth airport operations. The cost of such enabling works may not all be required at a green-field airport construction site.

B) Structural Design

The cost of the civil part of an airfield pavement will primarily depend on the structural design of the pavement consisting of different pavement layers, which is further dependent on a number of variables as listed below:

- Type of pavement (Flexible (i.e. bituminous) or Rigid (i.e. concrete))
- Design life
- Aircraft information
  - All anticipated aircraft in the traffic mix
  - Aircraft gross taxi weight
  - Wheel load, wheel locations and tire pressure
  - Annual aircraft departures
  - Annual growth in aircraft movements
- Sub grade strength (CBR value for flexible pavement and k-value for rigid pavement).
- Material characteristics
  - Type of materials (pavement layers)
  - Layer thickness (to be assigned for iteration purpose in the design process)

  - Elastic modulus (E)
  - Poisson's ratio (μ)
  - Flexural strength of concrete
- Aircraft wander effect and Pass-to-Coverage (P/C) ratio.

6.2 Variables Affecting Thickness Design

6.2.1 Type of Pavement

Generally two types of pavements are used: - flexible (bituminous) pavements and rigid (concrete) pavements. However, in some cases e.g. in an operational airport environment, a hybrid type pavement is sometimes used due to operational constraints. In all these types, different design philosophies are employed.

Flexible pavements

The design of a flexible pavement consists of a series of layers to distribute the load over the sub-grade. Loads are transmitted gradually, like a trapezoid, from the surface of the pavement to the top level of soil. Reduction of pressure is caused layer by layer. The pavement structure depends on its thickness over the sub-grade for reduction of the surface pressure to a value which the sub-grade can accept. The layers in the flexible pavement will flex (bend) under the load of a tyre. The objective of the design is to avoid the excessive flexing of any layer, which ultimately will cause the pavement to fail.

Rigid pavements

In rigid pavements, load is distributed by the slab action. The primary element of a rigid pavement is a layer of Portland Cement Concrete (PCC) which is much stiffer than Hot Mix Asphalt (flexible pavement) and because of its rigidity and high modulus of elasticity, distributes the loads by bending or beam action over a much wider area than the flexible pavement. Thickness design of only the PCC slab is performed and thickness designs of sub-base layers below the PCC slab have not been carried out in this analysis. Sub base layers below the PCC slab are provided for various other reasons such as control of pumping, providing uniform stable support for the pavement slab, drainage, etc. When sub-base layers are provided over the sub-grade, a higher k-value than the sub-grade k-value is considered in the thickness design and thus an additional advantage of sub-base layers below the PCC slab comes in terms of reduction in slab thickness.

From the above concepts of flexible and rigid designs, it become clear that there may be various combinations of layer system in the flexible design as each layer is a part of the thickness design whereas, in rigid pavements there are very limited options available as only the thickness of the PCC slab is designed.

6.2.2 Design Life

Design life is an important parameter in the design of aircraft pavements, different airports adopt different norms based on their capital outlay plans.

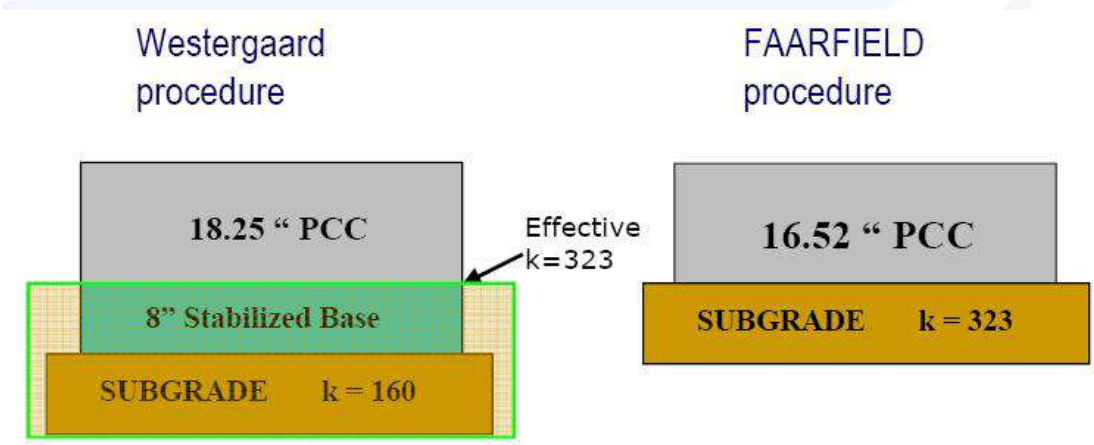
Normally Asphalt pavements are designed for 20 yrs and Rigid Pavements for 30- yrs. So design life can have impact of pavement layers and cost.

6.2.3 Design Principles

Based on our knowledge and understanding, previously AAI was following Design Curves as per FAA AC No. 150/5320-6D and ICAO Design Manual Part 3 and at present, all the AAI airports pavements are designed following the FAARFIELD methodology. The older approach has impact on layer types and subsequently on cost.

It is observed that, FAARFIELD results in a more economical pavement section than the previous method of using design curves based on Westergaard procedure. All the modern airports are using the software program 'FAARFIELD' for the structural design of airfield pavements based on Federal Aviation Administration (FAA) Advisory Circular No. 150/5320-6E (30 September 2009).

Figure 28: Different Procedures for Airfield Pavement Design



In rigid pavements variations in temperature and moisture content can cause volume changes and slab warping resulting in significant stresses. In order to reduce the detrimental effects of these stresses and to minimize random cracking, it is necessary to divide the rigid pavement into a series of slabs of predetermined dimensions by means of joints. To transfer the wheel load from slab to slab use of dummy joints or dowel bar joints are mostly employed. Dowel bar joints are generally more efficient than dummy joints and preferable when slab thickness is significant but these need more skilled manpower than dummy joints and the cost of dowel bar joints is also much more than that of dummy joints. As AAI airports are generally located in remote places, where skilled manpower may not be available, dowel bars are generally not used in AAI airports. The aircraft traffic load in most of the AAI airports also tend to be much lesser than major Indian airports, hence the slab thickness can also be usually less. FAA AC

150/5320-6E stipulates the use of FAARFIELD, suggests the use of dowel bar joints in slabs of thickness more than 9 inches (229 mm).

6.2.4 Anticipated Aircraft in the Traffic Mix

In the FAARFIELD method, all anticipated aircraft in the traffic mix need to be considered for the design input. Damage caused by each aircraft is summed up based upon its unique pavement loading characteristics and location of the main gear from the runway/taxiway center line. A Cumulative Damage Factor (CDF) and % contribution of each aircraft in the CDF are determined in accordance with Miner's rule.

Based on the CDF values, it is possible to ascertain which aircraft are critical for pavement damage and which airplanes cause negligible damage to the pavement.

The sizes of airport and types of aircraft operating have direct impacts on the CDF. As airport size increases it is most likely that heavier and more modern aircraft like the Boeing 777 series will operate there. For smaller airports, generally heavier and large aircraft do not operate and the impact on CDF by any particular aircraft may not be as severe as in the case of Boeing 777 aircraft. A design example is given below in this regard. Table 29 below shows the aircraft information used for design and Table 30 show the CDF contribution of each aircraft.

Table 29: Airplane Information

No.	Name	Gross Wt. tonnes	Annual Departures based on a major Indian airport	% Annual Growth
1	A319-100 std	64.400	9,521	3.00
2	A320-100	68.400	20,457	5.00
3	A321-100 std	83.400	4,292	3.00
4	A330-200 std	230.900	0	3.00
5	A330-200 opt	233.900	4,683	3.00
6	A330-300 std	230.900	3,668	3.00
7	A340-300 std	275.895	780	3.00
8	A340-300 std Belly	275.895	780	3.00
9	A340-600 std	365.200	312	10.00
10	A340-600 std Belly	365.200	312	10.00
11	A380-800	562.001	312	10.00
12	A310-200	142.900	78	3.00
13	A300-600 std	172.600	78	3.00
14	B737-300	63.503	468	3.00
15	B737-700	70.307	8,273	3.00
16	B737-800	79.243	41,831	5.00
17	B737-900 ER	85.366	9,287	3.00
18	B747-400ER Passenger	414.130	1,639	-10.00
19	B767-300 ER	187.334	4,370	3.00
20	B777-200 ER	298.464	4,448	3.00
21	B777-300 ER	352.441	7,336	5.00
22	B787-8 (Preliminary)	220.446	937	3.00

23	Dual Whl-75	34.019	780	3.00
24	Dual Whl-60	27.216	312	3.00
25	Dual Whl-50	22.680	468	3.00
26	Dual Whl-30	13.608	0	3.00
27	Dual Whl-75	34.019	0	3.00
28	Dual Whl-100	45.359	0	3.00

Table30: Subgrade CDF

No.	Name	CDF Contribution	CDF Max for Airplane	P/C Ratio
1	A319-100 std	0.00	0.00	1.09
2	A320-100	0.00	0.00	1.09
3	A321-100 std	0.00	0.00	1.08
4	A330-200 std	0.00	0.00	0.54
5	A330-200 opt	0.00	0.00	0.54
6	A330-300 std	0.00	0.00	0.54
7	A340-300 std	0.00	0.00	0.54
8	A340-300 std Belly	0.00	0.00	1.07
9	A340-600 std	0.00	0.00	0.54
10	A340-600 std Belly	0.00	0.00	0.53
11	A380-800	0.00	0.01	0.46
12	A310-200	0.00	0.00	0.81
13	A300-600 std	0.00	0.00	0.86
14	B737-300	0.00	0.00	1.11
15	B737-700	0.00	0.00	1.09
16	B737-800	0.00	0.00	1.09
17	B737-900 ER	0.00	0.00	1.09
18	B747-400ER Passenger	0.00	0.00	0.77
19	B767-300 ER	0.00	0.00	0.83
20	B777-200 ER	0.05	0.05	0.65
21	B777-300 ER	0.93	0.93	0.66
22	B787-8 (Preliminary)	0.00	0.00	0.80
23	Dual Whl-75	0.00	0.00	1.16
24	Dual Whl-60	0.00	0.00	1.21
25	Dual Whl-50	0.00	0.00	1.17
26	Dual Whl-30	0.00	0.00	1.28
27	Dual Whl-75	0.00	0.00	1.16
28	Dual Whl-100	0.00	0.00	1.15

It is assumed that when the CDF is 1, pavement design life is exhausted. From Table 29 and Table 30, it may be seen that out of a CDF value of 1.0, 0.93 is contributed by the Boeing 777-330 ER (weight 352.44 tonnes) and 0.05 is contributed by the Boeing 777-200 ER (weight 298.464 tonnes). Much heavier aircraft such as the Boeing 747-400 ER (weight 414.130 tonnes) and the Airbus A380-800 (weight 562.001 tonnes) have zero

contribution in the Cumulative Damage Factor, which indicates no damage to the pavement.

Aircraft gross taxi weight, wheel load, wheel location and tire pressure

This also depends on size of airport - metro airports generally have larger aircraft.

Annual departures and annual growth

The scheduled aircraft movements and annual growth varies from airport to airport and accordingly airfields with say 1,00,000 ATMs should not be compared with airfields with less than 50,000 ATMS.

6.2.5 Sub-Grade Strength

1) The sub-grade forms the foundation for the pavement. The subgrade soil ultimately provides the support for the pavement and the imposed loads. As per FAA guidelines for reporting the airport pavement strength, four standard levels of sub-grade strength based on CBR and k-value are adopted as shown in Table 31 and Table 32 below.

Table 31: Sub-grade Strength Category Based on CBR

Sub-grade Strength Category	Sub-grade Support CBR Value	Represents	Sub-grade Soil Code
High	15	CBR > 13	A
Medium	10	8 < CBR < 13	B
Low	6	4 < CBR < 8	C
Ultra Low	3	CBR < 4	D

Table 32: Sub-grade Strength Category Based on k-value

Sub-grade Strength Category	Sub-grade Support k-value, pci (MN/cum)	Represents	Sub-grade Soil Code
High	550 (150)	k > 440 (120)	A
Medium	300 (80)	220 < k < 440 (60 < k < 120)	B
Low	150 (40)	90 < k < 220 (25 < k < 60)	C
Ultra Low	75 (20)	k < 90 (25)	D

2) Sub-grade strength is one of the prime input parameters in the thickness design of airport pavements. There may be substantial variations in the design thickness from one sub-grade category to another and therefore the cost of the pavement will also vary significantly. Thus, it may not be appropriate to adopt a single subgrade strength category for benchmarking the design thickness and estimated costs.

3) The sub-grade soils generally encountered in different parts of India and their characteristics are broadly as below:

a) *Alluvial Soils of the Indo-Gangetic Belt* - These soils are found along vast tracts along the Indo-Gangetic plains. These soils have been deposited over time by the rivers of Ganga, Yamuna, and other tributaries. As per the Unified Soil Classification System the letter symbol of this soil type is CL-ML, CL and the soaked CBR value is 8 to 12.

b) *Alluvial Soils of Coastal Regions* - These soils are found along the coastal belt and the peninsular regions between the sea and the range of hills along the coast. As per the Unified Soil Classification System the letter symbol of this soil type is CL, CI, CH and the soaked CBR value 3 to 10.

c) *Lateritic Soils* - These soils are extensively found in the southern states as well as in Orissa, Maharashtra and Assam. Lateritic soils are derived from laterite rock formations. As per the Unified Soil Classification System the letter symbol of this soil type is CI and the soaked CBR value is 7 to 8.

d) *Black Cotton Soils* - These soils comprise of shallow to deep black soil occurring in the sub-humid tracts of Malwa plateau in M. P. and certain parts of Maharashtra and Gujrat. As per the Unified Soil Classification System, the letter symbol of this soil type is CH and the soaked CBR value is up to 3.

e) *Desert Soils* - These soils are found in the arid regions of north-western parts of India comprising the area between the Indus in the West and the Aravalli mountain ranges in the east, in the states of Rajasthan and Haryana. As per the Unified Soil Classification System the letter symbol of this soil type is CM and the soaked CBR value is up to 6.

4) From the above it can be observed that high strength sub-grades having CBR values of 15 and above are rare in India. Black cotton soils having soaked CBR values up to 3 are generally removed and refilled with good soil from borrow pits before construction and thus using an ultra-low sub-grade of CBR 3 as a foundation for a pavement is also very rare.

This is one of the major parameters affecting pavement design thickness (and hence costs) and this in no way is uniform across India.

6.2.6 Type of Materials (i.e. Pavement Layers)

1) In the FAARFIELD design procedure, materials are identified by their corresponding FAA specification designations. For example, crushed stone base course is identified as Item P-209. The type of layers and FAA item numbers used in the FAARFIELD for surface, base, and sub-base courses in the flexible pavement design are listed at Table 33 below.

2) A stabilized base course is necessary for new flexible pavements designed to accommodate aircraft weighing 100,000 lbs (45,359) kg or more. When a stabilized base course is required, it is recommended that a higher quality material is used for the sub-base.

3) Similarly, stabilized materials are required for a base / sub-base under a Portland Cement Concrete (PCC) surface in a rigid pavement serving aircraft weighing 100,000 lb (45,359 kg) or more. Up to three base / sub-base layers can be added to the pavement structure in FAARFIELD for new rigid pavement design.

4) The type of layers and FAA item nos. used in the FAARFIELD program for rigid pavement design are listed at Table 34.

Table 33: Different Pavement Layers for Use in Flexible Pavements

FAA Item	Layer Type
Surface Course	
P-401	Hot Mix Asphalt Surface Course
P-403	Hot Mix Asphalt Base, Leveling, or Surface Course
Base Course	
P-208	Aggregate Base Course
P-209	Crushed Aggregate Base Course
P-211	Lime Rock Base Course
P-219	Recycled Concrete Aggregate Base Course
P-304 #	Cement Treated Base Course
P-306 #	Econocrete Base Course
P-401 #	Hot Mix Asphalt Surface
P-403 #	Hot Mix Asphalt Base, Leveling, or Surface
-	Rubblized Portland Cement Concrete
# Stabilized Base Courses for Flexible Pavements.	
Sub-base Course	
P-154	Granular Sub-base Course
P-210	Caliche Base Course
P-212	Shell Base Course
P-213	Recycled Concrete Aggregate Base Course
P-301	Soil-Cement Base Course
Note-1: Item P-401 is to be used for surface course subject to airplane gross weights more than 12,500 lb (5670 kg). *Note-2*: Item P-403 may be used for surface course subject to airplane gross weights less than or equal to 12,500 lb (5670 kg) or for surface course of shoulder, blast pads, service roads etc. *Note-3*: Any material suitable for use as base course can also be used as sub-base if economy and practicality permit.	

Table 34: Different Pavement Layers for Use in Rigid Pavements

FAA Item	Layer Types
Surface Corse	
P-501	Portland Cement Concrete Pavement
Base / Sub-base Course	
P-154	Granular Sub-base Course
P-208	Aggregate Base Course
P-209	Crushed Aggregate Base Course
P-211	Lime Rock Base Course

P-301	Soil Cement Base Course
P-304 #	Cement Treated Base Course
P-306 #	Econocrete Base Course
P-401 #	Hot Mix Asphalt Surface Course
P-403 #	Hot Mix Asphalt Base, Leveling or Surface
	Rubblized Portland Cement Concrete
# Stabilized Base / Sub-base Course for Rigid Pavement	

5) Besides the pavement layers listed in Tables 33 and Table 34, there are provisions for use of an "Undefined" layer and a "Variable" layer to allow the use of customized layers or layers not covered by the most common structural materials and to investigate the effects of using new or otherwise non-standard materials.

6) From the above, it may be seen that there are a very large number of material types (pavement layers) which may be adopted in the thickness design.

It is quite evident that a single design basis cannot be adopted for all airfield pavements or even across two airports.

7) A limited analysis based on pavement layers which are generally used in flexible and rigid pavements in Indian airports and are similar to FAA items are indicated in Table 35 below.

8)

Table 35: Similar Pavement Layers to FAA Items used in Indian Airports

FAA Item and Type of Layer	Items Similar to FAA Items Used in Indian Airports	Recommended
P-401, Hot Mix Asphalt Surface	Dense Asphalt Concrete (DAC)	Flexible Surface Course
P-403, Hot Mix Asphalt Base, Leveling, or Surface	Semi-Dense Asphalt Concrete (SDAC), Dense Bituminous Macadam (DBM), Bituminous Macadam (BM)	Stabilized Base Course
P-501, Portland Cement Concrete Pavement	Pavement Quality Concrete (PQC)	Rigid Surface Course
P-209, Crushed Aggregate Base Course	Water Bound Macadam (WBM), Wet Mix Macadam (WMM)	Base Course
P-304, Cement Treated Base	Dry Rolled Lean Concrete Base (DLC)	Stabilized Base Course
P-154, Granular Sub-base Course	Granular Sub-base (GSB)	Subbase Course

6.2.7 Flexural Strength of Concrete

For rigid pavements, the flexural strength is an additional material characteristic which is used as an input parameter. FAA recommends the value of concrete flexural strength within the range of 600 – 700 psi (4.14 to 4.83 MPa) for design purposes.

6.2.8 Aircraft Wander Effect and Pass-to-Coverage (P/C) Ratio

As an aircraft moves along a pavement section it seldom travels in a perfectly straight path or along the same path as the aircraft before. This lateral movement is known as 'aircraft wander' and is statistically normally distributed about the pavement centerline. Aircraft wander is considered for computation of the Pass-to-Coverage Ratio. The degree of 'wander' is typically characterized by a Standard Deviation (SD). Aircraft Wander is significantly different for runways, taxiways and aircraft docking bays varying from 200 mm (for airplane docking bays) to 1600 mm (for runways). The transverse spreading of load to different degrees due to aircraft 'wander' significantly affects pavement life.

In addition to the above, we recognize that airfield pavement costs would vary on account of multiple factors as illustrated below:

- Provisioning of pavement shoulders as per DGCA/ICAO requirements;
- Other incidental parameters such as AGL, drainage, civil costs, basic strip, turfing etc.;
- Geographical location of the project
- Available source of material;
- Municipal restrictions – may limit working time;
- Large lead times for delivery of materials;
- Site constraints – resulting in multiple handling;
- Environmental issues.

The space availability and natural resources affecting the construction cost varies for each location such as disposal area for excavated material, availability of raw materials for construction such as sand, Murom etc. (due to banned mining the cost of sand has risen significantly due to large lead time), construction water availability, local construction norms etc.

Labour wages and Local taxes and duties - minimum wages are applicable to each location are not uniform across India, they vary from city to city and from state to state.

The incidence of the costs is directly related to various parameters which change within and between states. There is no tax uniformity across India. Mumbai is subject to the additional burden of Octroi ranging from 5.5% to 7%, while Bangalore has an entry tax.

6.3 CONCLUSIONS

In view of the various parameters affecting the design and therefore the cost of pavements, setting a ceiling cost rate (or norm) for airfield pavements would not be suitable to fit all scenarios.

The design of airport pavements is a complex engineering problem that involves a large number of interacting variables. Many of these variables will differ from airport to airport and cannot be fixed at a particular value for design purposes. Aircraft information (all anticipated aircraft in the traffic mix, aircraft weight, gear configuration, annual departures and annual growth) will have a substantial impact on the design thickness of the pavement and it is very likely that these input parameters will differ from airport to airport i.e. the cost per sqm of a Code 4C runway at a regional airport is likely to be very different to that of a Code 4F runway at a major international airport. Similarly, sub-grade strength will vary from airport to airport and this will also have major effect on the required pavement thickness. Furthermore, pavement construction at an operational airport is likely to be less efficient and therefore more costly than pavement construction at a green-field airport.

In view of these various parameters significantly affecting the design and construction, and therefore costs of airfield pavements, a ceiling rate for airfield pavements would not be suitable to fit all scenarios. Unless design norms are standardized in Indian context, fixing pavement costs to a single value is not justified.

Section 7

Conclusions & Recommendations

7 CONCLUSIONS & RECOMMENDATIONS

There should be no 'One Size Fits All' policy

No airport is identical to another airport in terms of the market that it serves and hence the infrastructure that it provides. Different airports also operate to different business strategies and priorities, serve different customer bases (both airlines and passengers) and adopt different target levels of service (and for PPP airports these target levels of service are defined within the concession agreements). This is borne out by analysis of the average floor area (sqm) per each 1 million annual passengers for integrated terminals at a variety of airports in India and Asia. The range seen across different passenger terminals that we have reviewed is approximately 8,000 – 19,000 sqm per million passengers per annum (mppa). There is no strong correlation between the sqm area per mppa and the International Air Transport Association (IATA) Level of Service (LoS) adopted for terminal planning. For example, Beijing Capital International Airport Terminal 3 was planned to LoS 'C' but has a higher floor area per mppa than Singapore Changi Airport Terminal 3 (planned at LoS 'A') and Hong Kong International Airport Terminal 1 (planned at LoS 'B'). We understand that this is because Beijing Capital International Airport Terminal 3 was designed with some special local space requirements related to the Olympic Games.

Airport terminals are highly complex pieces of infrastructure and their configurations and layouts respond to the target markets and proposed levels of service but also reflect local constraints and challenges. For example, construction of a high international mix passenger terminal on a constrained terminal development site will require a different solution to the construction of a low international passenger mix terminal (dominated by domestic passengers) on a less constrained site. The outcomes in terms of area per mppa or peak hour passenger are likely to be very different for these two scenarios. No 'one size fits all'. Flexibility in space provision is required to allow airport operators to respond to the local market and conditions.

Airport Terminal Planning – IATA ADRM is the International Standard Methodology

AERA has suggested that integrated terminals in India should be constructed using the IMG norm of 25 sqm per Peak Hour Passenger (PHP). It is understood that this norm originated from AAI, although there does not seem to be any background analysis available on how this norm was derived, and therefore how it should be applied. Without a clear basis showing how the 25 sqm/PHP has been derived and how it should be applied could result in misinterpretation and incorrect application by different airport operators. For example, some airport operators might assume that this norm applies to the total airport area, whereas others may assume that it applies to the passenger processing areas only.

Whilst AAI may wish to impose a guideline standard across the airports that it owns and operates, the rationale for imposing similar standards on all other airport operators in India by AERA is less than obvious. We argue above that there should be no 'one size fits all' policy for airport terminals in India because, when operational terminals are benchmarked against each other, it is clear that very few comparisons can be made; they are all different because they have different goals, ambitions and aspirations and different markets to serve. In addition, airports have different operating models (integrated domestic and international operations or non-integrated separate domestic and international operations). A single space standard cannot be applied across the three different types of terminals. Typically domestic-only terminals generally require less space per passenger than international terminals because there is less

need for processing facilities such as immigration and emigration checkpoints. Integrated terminals also need to provide additional operational areas for the processing of international-domestic passenger transfers. On the other hand, integrated terminals may have the opportunity to be highly efficient in terms of space per passenger because it is often the case that domestic and international traffic peaks do not coincide, and so with careful planning (as is the case at Bangalore Airport) facilities can be used flexibly between domestic and international operations i.e. 'swing' facilities can be introduced that can be used at one point in time as domestic and then, using partitions, can become part of the international facilities. Separate domestic and international terminals cannot achieve this efficient use of infrastructure and where domestic and international traffic peaks do not coincide there is a resultant inefficient use of non-integrated airport terminal infrastructure. At Bangalore Airport, this highly efficient use of infrastructure results in a relatively low sqm per PHP compared to some other airports in India.

The relatively low sqm/PHP value for Bangalore Airport can perhaps be explained by the fact that Terminal 1 is an expansion of an existing terminal with an ultimate capacity of 20mppa, but it has a single level curb and a linear terminal configuration. It does not have Domestic to International transfers and so, in some respects, it is a relatively simple terminal. On the other hand, Terminal 2 will have a capacity of 35 mppa with a two level curb, access to the future metro line and a multi-storey car park. Terminal 2 will be a fully integrated terminal with all the required transfer facilities for passengers and bags. This terminal will be much more complex than Terminal 1 and hence its area cannot necessarily be constrained to 25sqm/PHP.

There is an answer to this problem of adopting a blanket 'top-down' area space standard across different terminal types at different locations with different operating models, goals, service standards and business objectives. There is an internationally recognized approach to airport terminal planning that can accommodate all this natural variability; this is enshrined in the IATA Airport Development Reference Manual (ADRM). The advantages to using the IATA method for defining the required space within a passenger terminal are very clear:

- It is the internationally recognized method;
- It is based on a clear and scientific 'bottom-up' methodology;
- It allows local traffic characteristics to be taken into account;
- It allows the space to be provided to vary according to target levels of service; and
- It is a methodology recognized and supported by airports key customers – the airlines.

None of the above is true for the proposed IMG Norm.

The ADRM passenger terminal space calculation methodology is a 'bottom-up' process using locally specific parameters. However, ADRM also does give some 'top-down' guidance on the space that should be provided on a PHP basis. ADRM9 says that "Experience has shown that, when designing facilities for purely domestic or charter passengers, the corresponding maximum sqm/PHP figure should not exceed 25 sqm and 30 sqm respectively." ADRM10 indicates that 35 sqm/PHP should be provided for international passengers.

The ADRM 'bottom-up' passenger terminal space calculation methodology primarily works on a Peak Hour Passenger basis. The main drive with ADRM is to provide a bottom-up methodology for calculating the process requirements and process areas for each main part of a passenger terminal (check-in, security search, immigration, baggage reclaim etc.). ADRM gives space standards for waiting areas and waiting time standards based on the defined Level of Service (LoS). Sizing calculations then use a variety of locally specific parameters such as forecast

passenger traffic volumes and observed local processing (or transaction) times (e.g. average check-in transaction time) along with the IATA Level of Service parameters which depend on the adopted Level of Service for the airport. The process is not simple and there are many variables that will impact on required sizing calculations, examples of these variables are described below; it can be seen that many of these variables are airport specific.

A single space standard value applied to the volume of peak hour passengers to calculate a total floor area requirement may be too generalized as the same level of service can require different sqm/PHP provision for the different functional areas across a terminal. The sqm/PHP provision for circulation areas and processing areas at the same level of service will be different. The sqm/PHP for different processing facilities at the same level of service will also be different. This is due to the different processing facilities being located along the sequence of departures or arrivals processing, and hence whether passengers specifically are carrying check-in bags (or pushing trolleys with check-in bags) or only have their hand-carried bags with them.

The LoS framework set-out in the IATA ADRM provides the guidelines on sqm/PHP space standards (as well as waiting time standards, as the other important variable to consider for the level of service). It provides a range of values for these, for each passenger terminal processor, which can be customized for local factors, such as the space standards which are dependent on the average number of check-in bags carried by each passenger. The IATA LoS framework has been revised in the 10th edition of ADRM, to redefine the previous scale of LoS A to E as Overdesign, Optimum, and Sub-Optimum. IATA now recommends 'Optimum' (equivalent to the former LoS 'C') as the ideal standard that best balances the provision of a good level of service whilst avoiding the cost of over-provision.

All of these inputs combine to create the required size of a particular processing area and the number of processing units within it. The terminal planning process then assembles these various outputs into a cohesive terminal plan according to the available site area, constraints and local operating model. It is clear that the required area for a terminal results from local specific conditions and requirements and should not be determined by a 'top-down' blanket standard across all airports.

Moreover, it can be seen that the international standard airport terminal planning methodology requires locally defined service quality to be defined and input to the planning process. Imposition of a 'top-down' standard by the regulator for the area of a terminal would mean that it may not be possible for an airport to meet its defined and agreed service standards and defined IATA LoS. If these service quality standards are themselves imposed by the regulator within concession agreements and at the same time the regulator is suggesting imposition of such a 'top-down' area standard which works against achievement of the service quality standards, then these contradictory regulatory mechanisms would place the airport regulator in an impossible position.

Cochin Airport is not a Valid Comparator Airport for Benchmarking Purposes

Cochin Airport handled approximately 5.4 million passengers in the 12 months ending March 2014. Cochin Airport is a relatively small airport compared to the major airports in India such as Delhi and Mumbai Airports, which each handled more than 30 million passengers in the same 12 month time period. Bangalore Airport handled 2.4 times the passenger traffic at Cochin Airport in the 12 month period ending March 2014.

Cochin Airport handles a relatively high proportion of international traffic (approximately 60% international and 40% domestic) when compared to other airports in India which are typically 20-30% international and 70-80% domestic. The key issue here is the market at Cochin Airport is completely different to the market at other airports in India. At Cochin there is a strong overseas worker passenger component not seen in such proportions at other airports in India, which reflects the difference in the prevalent market served by Cochin Airport and to some extent explains why the airport operator has chosen to provide a functional facility without any major aspirations for attaining high service standards.

Annual aircraft movements at India's busiest airports are around 300,000 movements per annum and at Bangalore Airport the annual aircraft movements are approximately 120,000. On the other hand at Cochin Airport annual aircraft movements are less than 50,000 movements.

Clearly Cochin Airport is a different scale airport to many other airports in India, it has different operational characteristics, market and operating model. At the larger airports, increased passenger numbers and ATMs not only bring the need for more space but also bring operational complexities and the need for more complex infrastructure and operational procedures.

Our analysis of the airport terminal facilities provisioned or planned to be provisioned at Cochin Airport show that these tend to be significantly lower than the facilities at the larger benchmark airports. While, it is understood that Cochin Airport's facilities may be sufficient for meeting the local requirements, the business model and approach to the provision of airport facilities does not appear to fit with the requirements at much larger airports. Cochin Airport has been developed as a low-cost, functional airport with basic facilities, which serves the requirements of its present users. We conclude that comparing such an airport with larger airports at metro cities for the purposes of benchmarking and setting norms at these larger airports is not advisable.

Our analysis of a variety of different parameters indicates that the terminals at Cochin Airport are similar to a Low Cost terminal having much smaller dimensions where the provided passenger service quality is relatively basic. The airport authorities themselves market the airport as a pioneer in developing a low-cost, functional airport. And whilst there is nothing wrong with that as it serves a particular market, translating that model to other larger airports in India may not be appropriate.

Airport Service Quality – It's Delivered Service and Customer Satisfaction that Counts

The service quality at the integrated terminals in India has been benchmarked. The benchmarking analysis in this report covers Delhi (T-3), Mumbai (T-2), Kolkata (new terminal) and Bangalore (upgraded T-1) Airports.

All four airports reviewed in the main benchmarking analysis partake fully in the ACI Airport Service Quality (ASQ) survey (the world's leading customer satisfaction benchmark survey) and report results on a monthly basis. The results are based on passenger interviews undertaken at each airport and passengers are asked to rate various aspects of service on a scale of 1 to 5. One of the key measures contained in the ASQ survey is 'Overall Satisfaction with the Airport' which attempts to provide an overall sense of customer satisfaction at the airport and as such is influenced by some factors and services provided which may be outside of the direct control of the airport operator. For Q2-2014 Bangalore scored a very respectable 4.49, higher than Kolkata Airport (4.42) but lower than Mumbai and Delhi Airports (4.89 and 4.74 respectively). Cochin Airport does not directly partake in the ACI ASQ survey but employs an ACI authorized agency to

undertake customer satisfaction surveys. Cochin Airport only publishes data on 'Overall Satisfaction with the Airport'. Cochin Airport's Q2-2014 score for 'Overall Satisfaction with the Airport' was 3.70 which is significantly less than scores achieved by other airports in India (assuming that the ASQ surveys results for 'Overall Satisfaction with the Airport' can be fairly compared to the Cochin Airport reported score for the same measure).

It is important to note that ASQ results are based on the direct ratings of individual processing facilities in a terminal by the passengers who have been surveyed. The results therefore give a true reflection of service, as opposed to an overall sqm/PHP value which is simply a proxy for service which cannot factor in the myriad of operational and service variables that influence the overall impression of an airport by a passenger. ASQ scores directly verify the service levels that are provided and as such are a preferable regulatory mechanism than the rather blunt area/PHP mechanism.

The trend in 'Overall Satisfaction with the Airport' over the last 4 quarters makes interesting reading. At Delhi and Mumbai Airports, the overall satisfaction score has remained relatively constant. At Bangalore and Kolkata Airports, there has been a significant upward trend in overall satisfaction owing to the recent introduction of new terminal infrastructure. At Cochin Airport, overall satisfaction has remained relatively low and constant over the last four quarters with some evidence of a slight decline from Q1-2014 to Q2-2014.

Terminal Cost Norms

Airport facilities can reasonably vary in specification and price for a number of compelling reasons including traffic type, degree of peaking, facility specifications, complexity of the operation, the needs of users, and local costs and conditions etc. There is a wide range of such issues influencing the cost of airport terminals, most of which may account for legitimate differences between the costs of airport passenger terminals across India. It appears that AERA may not have accounted for all these factors while fixing the cost of INR 65,000 per sqm.

The indexed construction costs expended for all the recently developed major airports in India show that construction cost varies from location to location and from trade to trade due to various factors as elaborated in the previous sections of this report and is in the range of INR 112,000 – 148,000 per sqm, significantly above the suggested INR 65,000 per sqm benchmark norm.

In addition to analyzing costs on a per sqm basis in line with the proposed AERA norm we have also looked at costs in a different way by calculating the cost per mppa. This simply gives an indication of the cost effectiveness and utilization of the terminal. This is also commensurate with the tariff determination process as it considers *annual passenger throughput* for determining the applicable development fee. ICAO also, by its cost effectiveness measure, emphasizes on terminal cost productivity considering *annual passenger throughput* criteria.

Cost per mppa comparison shows that Bangalore Airport T1 is cost efficient and in this respect compares well to all other benchmarked airports with a cost per mppa equivalent to Chennai Airport and lower than Delhi, Mumbai, Kolkata and Cochin Airports.

We have further attempted to estimate broad costs for construction of a terminal building based on CPWD methodology (base parameters that the construction industry references across the country). On the basis of our calculation, we note that the cost for an airport terminal

building, including other airport system related costs, range upwards of INR 149,000 per sqm and the cost of INR 65,000 per sqm, as recommended by AERA, is not feasible.

Furthermore, the cost of construction of a terminal, to a large extent, is based on the operational requirements and the design specification of the terminal. So unless the operations of all terminals and the specifications and complexity (including baggage handling system types, use of aerobridges, IT system complexities etc.) can be standardized across all airports across all of India i.e. all airports are expected to look and function in exactly the same way (even though they cater for different markets), then it appears not sensible to restrict development through the imposition of a maximum cost per sqm norm. Costs are clearly a function of the required performance levels and also the complexity of the infrastructure which will vary from airport to airport.

Therefore, any 'one-size fits all' approach is not appropriate for terminal building costs. Larger terminals often require more complex facilities leading to higher CAPEX. A range of other factors mean that what is cost effective at one terminal may not be at another.

Airfield Pavement Cost Norms

The design of airport pavements is a complex engineering problem that involves a large number of interacting variables. Many of these variables will differ from airport to airport and cannot be fixed at a particular value for design purposes. Aircraft information (all anticipated aircraft in the traffic mix, aircraft weight, gear configuration, annual departures and annual growth) will have a substantial impact on the design thickness of the pavement and it is very likely that these input parameters will differ from airport to airport i.e. the cost per sqm of a Code 4C runway at a regional airport is likely to be very different to that of a Code 4F runway at a major international airport. Similarly, sub-grade strength will vary from airport to airport and this will also have major effect on the required pavement thickness. Furthermore, pavement construction at an operational airport is likely to be less efficient and therefore more costly than pavement construction at a green-field airport.

In view of these various parameters significantly affecting the design and construction, and therefore costs of airfield pavements, a ceiling rate for airfield pavements would not be suitable to fit all scenarios. Unless design norms are standardized in Indian context, fixing pavement costs to a single value is not justified.

Risks Arising from the Imposition of Space and Cost Norms

Contradictory regulation placing airport operators in an impossible position – i.e. restricting space per passenger whilst at the same time imposing service quality standards and levels which, in a large part, are a function of the terminal space provided. Such a measure could reduce customer satisfaction and destroy the very significant gains that have been achieved in terms of improved customer service and customers' perception of airports in India that have been achieved in recent decades.

Our benchmarking exercise indicates an average range of 25 to 40 sqm per PHP for integrated terminals in India which when compared to existing standards of similar airports in the Asia-Pacific region is relatively low but could meet AERA's conservative requirements. However, the setting of any area/PHP limits, whether high or low, will restrict an airport developers options for the future. For example, we do not know how efficient terminal operations will become in future and how technology will change fixed infrastructure requirements. Full automation of the

check-in process using internet check-in and electronic boarding cards is a distinct possibility, this would significantly impact space requirements and, perversely, the suggested lower limit may in fact in the future force an airport operator to over-provide. On the other hand the higher limit may restrict an airport operator's options in the future for provision of added value services at the airport that may not be core operational requirements but which could generate additional revenues and perhaps offset aeronautical charges. In summary, whist a range for the sqm per PHP is preferable to a single set value, even a range could cause inflexibility in the future provision of airport terminal space.

Restricting the cost of terminal construction to INR 65,000 per sqm. This will limit airport operators' options in terms of the quality of construction and quality of finishes that can be introduced in new airport terminal infrastructure. It will limit future construction to a 'low cost' type of facility. Such a measure is likely to reduce customer satisfaction and destroy the very significant gains that have been achieved in terms of improved customer service and customers' perception of airports in India that have been achieved in recent decades. We believe it is not correct to suggest that INR 65,000 per sqm should be sufficient for all future scenarios and eventualities on the basis that AERA expects the cost for the new Cochin Airport terminal to out-turn at around INR 43,333/sqm because the Cochin Airport benchmark cost does not include for full fit-out of the constructed terminal space and the operational specification of the Cochin Airport terminal is much lower than that required at major international airports in India; for example at Cochin Airport there will be no passenger boarding bridges, the baggage system will be very simple, there will be no domestic-international transfer facility and the fit-out and furniture quality will be very modest. This specification, whilst appropriate for Cochin Airport would not be suitable for a large international airport. India's large international airports are the first and last impressions of the country experienced by overseas leisure and business travelers. It should also be noted that whilst AERA is confident on the out-turn cost for the new Cochin Airport terminal of INR 43,333/sqm this is still a forecast cost and the eventually actual out-turn cost could be somewhat different to this figure.

It is recognized that airfield pavement costs vary on account of multiple factors, such as traffic levels, type and mix of aircraft, type of airfield pavement (flexible, rigid, hybrid), provisioning of pavement shoulders as per DGCA/ICAO requirements, other incidental parameters (AGL, drainage, civil costs, basic strip, turfing etc.), geographical location of the project, municipal restrictions, large lead times for the delivery of materials and site constraints and very importantly the strength of the ground on which the pavement will be built; this varies significantly across the various locations. Accordingly, a ceiling rate for airfield pavements would not be suitable to fit all scenarios.

Glossary

AAI	Airports Authority Of India
ACI	Airport Council International
AERA	Airports Economic Regulatory Authority
AERAAT	AERA Appellate Tribunal
ASQ	Airport Service Quality
ATRS	Air Transport Research Society
BIAL	Bangalore International Airport Limited
CPWD	Central Public Works Department
DIAL	Delhi International Airport Limited
GoI	Government of India
IATA	International Air Transport Association
IMG	Inter- Ministerial Group
INR	Indian National Rupee
LoS	Level of Service
MIAL	Mumbai International Airport
MoCA	Ministry of Civil Aviation
MPPA	Million Passenger Per Annum
OMDA	Operation Maintenance and Development Agreement
PHP	Peak Hour Passengers
PLF	Passenger Load Factor
PPP	Public Private Partnership
Sqm	Square meter