
FINAL REPORT

FOR

“TECHNICAL AUDIT FOR MIDTERM REVIEW OF MIAL'S PROJECT COST ESTIMATES”

FOR

AIRPORTS AUTHORITY OF INDIA



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TABLE OF CONTENT

| SL.NO. | DESCRIPTION |
|--------|--|
| | Preamble & Executive Summary |
| 1. | Introduction |
| 2. | Project Details & Scope of work |
| 3. | EIL's Approach Methodology for Technical Audit w.r.t. Master Plan, MDP |
| 4. | Assessment of Project Implementation |
| 5. | Cost Overrun |
| 6. | Possible Technical Alternatives |
| 7. | Project Management |
| 8. | Recommendations |
| 9. | Acknowledgement |
| 10. | Conclusion |

ANNEXURES

Annexure – I
Annexure – II
Annexure – III
Annexure – IV
Annexure – V
Annexure – VI
Annexure – VII
Annexure – VIII
Annexure – IV
Annexure – X

ACRONYMS

AAI – Airports Authority of India
AERA – Airports Economic Regulatory Authority of India
AOCC – Airport Operation control Centre
ATC – Air Traffic Control
ACC – Area Control Centre
BHS – Baggage Handling System
CSIA – Chhatrapati Shivaji International Airport
CWP- Contractor's Work Portion
CMS – Control Monitoring System
CAPEX – Capital Expenditure
CCTV – Close Circuit Television
COMFAA – Computer software used for Runway Designing
DVOR- Doppler VHF Omi-directional Radio Range
EPC- Engineering Procurement & construction
FIDS – Flight Information Display System
FIM- Free issue Material
GOI – Government of India
HVAC – Heat Ventilation & Air Conditioning
HFWD – Heavy Falling Weight Deflectometer
IATA – International Air Transport Association
IE – Independent Engineer
ICAO – International Civil Aviation Organization
IDF – Indian Development Fund
ILS – Instrument Landing System
JVC – Joint Venture Company
LHS- Left Hand Side
MCGM- Municipal Corporation of Greater Mumbai
MIAL – Mumbai International Airport Limited
MDP – Major Development Plan
MLCP – Multi Level Car Parking
NAD – National Airport Division
NCUT – New Common User Terminal
OMDA – Operation, Management & Development Agreement
PAPI- Precision Approach Path Indicator
PMC – Project Management Consultancy
PCCR – Primary Computer Control Room
PQC- Pavement Quality Concrete
RVR- Runway Visual Range
RHS- Right Hand Side
RFQ-Request for Qualification
SCCR – Secondary Computer Control Room
SCP- Sub Contract Packages
SRFF – Satellite Rescue & Fire Fighting
SWP- South West Pier
STP- Sewerage Treatment Plant
TCE – Tata Consulting Engineers
UDF – User Development Fee
VGDC- Visual Guidance Docking System

NAME OF WORK: AUDIT OF MIAL's PROJECT COST ESTIMATES

**PROJECT: MODERNISATION AND UPGRADATION OF
"CHHATRAPATI SHIVAJI INTERNATIONAL AIRPORT"
FACILITIES AT MUMBAI**

PREAMBLE

PURPOSE:

Airports Authority of India intends to carry out Technical Audit of MIAL's Project Cost Estimates to verify the Capital Expenditure estimated for the Construction of Airport Facilities at Mumbai.

AAI have appointed Engineers India Limited as a Technical Auditor (TA) for Audit of Mid Term Review of MIAL's Project Cost Estimates vide their letter no. AAI/MC/JVC-03/IA/2011-12/1620 dated 01-11-2011.

SCOPE OF WORK:

- a. Assess whether the project implementation plan, timelines, project cost including contingency cost estimates were developed by MIAL in accordance with the approved Master Plan and Major Development plans, any relevant agreements with GOI / AAI and generally accepted best practices.
- b. Assess whether the quantities calculated for estimating the project cost to completion are in line with the plans, drawings and specification as agreed to by the Board and Airport authority of India.
- c. Review the rates being considered for estimating the project cost.
- d. Assess whether all possible technical alternatives (e.g. alternate materials, revised design, reduced material quantity, parallel processing etc.) were considered and optimum plans were selected and implemented by MIAL to contain the cost overrun.
- e. Assess the quantity/ rate variance between the project cost estimates submitted by MIAL and the estimates submitted at the time of initial ad-hoc approval of DF
- f. Assess whether Project Management Techniques are being effectively used.
- g. Comments on any other related/connected issues and suggest mid term corrections/ measures, if and wherever required.
- h. Assist the Authority in the deliberations regarding proposal made by MIAL, based upon their Audit of the project cost.

EXECUTIVE SUMMARY

The objective of this study is to assess the Project Cost estimated by MIAL (JVC) for the construction of different components of Chhatrapati Shivaji International Airport (CSIA) of Mumbai. Being in the financial capital and a key gateway of the country, redevelopment of CSIA holds great significance in aiding the city to retain its fast paced growth. On 3rd of May 2006, the consortium led by GVK was awarded the mandate to modernize and redevelop CSIA.

Phase 1: (Completed by 2008)

- International car park expansion
- New high speed taxiways
- Apron expansion
- New domestic terminal car park
- Resurfacing of secondary runway 14/32
- Crash fire tenders and upgradation on airport facilities

Phase 2: (Completed by 2010)

- Amalgamation of Terminal 2B & 2C
- International terminal expansion
- Construction of New Domestic Terminal (T1C)
- Construction of Apron
- Parallel taxiway to Runways 09/27 & 14/32
- Upgrading Runway & Taxiways including RET to Code F compliance

Phase 3: (Under construction & Scheduled to be commissioned by 2014)

- Construction of New Integrated Terminal for Domestic & International - T2
- Multilevel car parking for 5200 (approx.) cars
- Sahar access road
- Mithi river Diversion
- Construction of New T2 Apron
- Construction of ATC tower

The project was scheduled to complete by March 2012 for International operations and March 2013 for Domestic operations. But the project got rescheduled due to the delayed handing over of related areas, the scheduled date for completion of Common Processor Terminal by 31st March 2012 is likely to be delayed to August 2013 for International Operation and August 2014 for Domestic Operations.

After completion of SW Pier & Common Processor Terminal, the existing T2B & T2C would be demolished. The work on the balance 3 Piers (SE, NE & NW) would commence after completion of Common Processor Terminal and is expected to be completed within one year (Domestic operations are forecasted as August'2014).

The major issues which have delayed the project are given below:

1. **Shifting of Shivaji Statue:** The Shivaji statue was falling in the footprint of the new common user terminal and the statue area was scheduled to be handed over by 31st March 2010. However, the approval from government for relocating the statue got delayed by 17 months which affected area of 50000 sq.ft (approx.) works including the structural works, concreting works, underground works and mega column erection of head house roof works thus impacting the overall testing & commissioning, which lead to delay in project completion. On 27th August 2011, statue got relocated and the area was handed over for construction.
2. The existing NACIL facilities including hanger, centralized kitchen, office, sewage utility & sump etc. are hindering the start of work for North-West Pier along with its related contact apron of the Integral Terminal.

Technical Auditors have worked exhaustively and found few variations from Master plan 2007 and MDP which have been discussed later in the report. The cost of the Project is within the cost bench marked by M/s Jacobs Consultancy, but it is on the upper side for some works when we gauge it with best industrial practices prevailing in India. Best industrial practices mean the norms followed by construction industry for various Infrastructure Projects being executed by CPWD, various PSU's and private promoters in India.

Various clauses and annexure of this report will elaborate the basis of increase in cost. There was a slippage on the part of JVC regarding non-approval of various changes made during execution stage.

Due to high risk involved in the Project, the % age of risk premium considered by Principal contractor and sub-contractor are also high which are totally borne by JVC resulting into further increase in Project Cost.

As per Technical Auditor, the amount to be excluded from the Project cost is shown in Annexure – I of this Report.

Summary of Project Cost ₹ in Crore is depicted below:

Table-1:

| Description | Initial Cost (Jan 2009) | Revised Cost- I (Oct 2010) | Revised Cost- II (Oct 2011) | Cost As Per Auditor | Remarks |
|---|-------------------------|----------------------------|-----------------------------|---------------------|-------------------------------------|
| T1 Projects | 397 | 423 | 453 | 399 | Refer clause no 5.6 |
| T2 Projects | 4337 | 4569 | 5083 | 5082.40 | Refer Table no.8 |
| Runway, Taxiway & Apron | 1164 | 1418 | 1545 | 1512.66 | Refer clause no 5.1, 5.2 & 5.3 |
| Landside projects | 41 | 41 | 41 | 40 | Refer clause no.5.13 |
| Miscellaneous projects | 471 | 579 | 562 | 512 | Refer clause no 5.12 |
| AAI works taken over (5.4 of OMDA) | 24 | 24 | 24 | 24 | |
| Technical services & Consultancies | 733 | 743 | 834 | 834 | |
| Capital expenditure for Operations | 118 | 118 | 118 | 118 | |
| Pre-operative Expenses | 415 | 479 | 684 | 684 | To be reviewed by Financial Auditor |
| Capitalized Interest | 1632 | 1069 | 1410 | 1410 | |
| Upfront Fee paid to AAI | 150 | 154 | 154 | - | Refer Cl. No.5.7 |
| ATC Equipments cost & Technical block in NAD colony | - | 310 | 310 | 110 | Refer clause no.5.4 |
| Contribution to MMRDA for sahar elevated road | - | 166 | 166 | 166 | Refer Annexure-X |
| WHSS-Shivaji Smarak / Memorial | - | 25 | 25 | 25 | Refer clause no.5.9 |
| Mithi River realignment | - | 150 | 150 | 150 | Refer clause no.5.14. |
| RET N5 & E2 | - | - | 51 | 50.25 | Refer clause no.5.8 |
| Enabling cost for taking over of carved out assets (NAD colony) | - | - | 110 | - | Refer clause no.5.11 |
| Cost of settlement of land | - | - | 30 | - | Refer Note 4 below |
| Project Cost | 9482 | 10,268 | 11,750 | 11117.31 | |
| Escalation & Claims | 320 | 185 | 450 | 450 | Refer clause no.5.15 |
| Contingency | | | 180 | 180 | |
| Total Project Cost | 9802 | 10,453 | 12,380 | 11,747.31 | |

Note: 1) As per MIAL report, the total revised project cost is ₹12,380 Crs out of which ₹9086.22 Crs has been committed as on 31st March 2012. The value of work done is 6966.99 crs as on 31st March 2012. The detailed breakup of the committed cost and incurred cost is shown in Annexure-II

2) As MLCP & International cargo expansion had been shifted to BOT basis, the initial project cost should have been ₹ 9327 Crs instead of ₹ 9802 Crs.

3) The initial Project cost got revised from ₹9327 Crs to ₹10,453 Crs due to some additional scope such as AGL works, T1C hotel & miscellaneous works [relocation of NACIL, yellow fever hospital, BMC drainage works, police station & boundary wall (new acquired lands)] and revision of cost which was ₹475 Crs and also additional new projects of ₹ 651 Crs.

4) The settlement of land has not been finalized which is under discussion with owners. It may be considered after the settlement of land is finalized.

1.0 INTRODUCTION

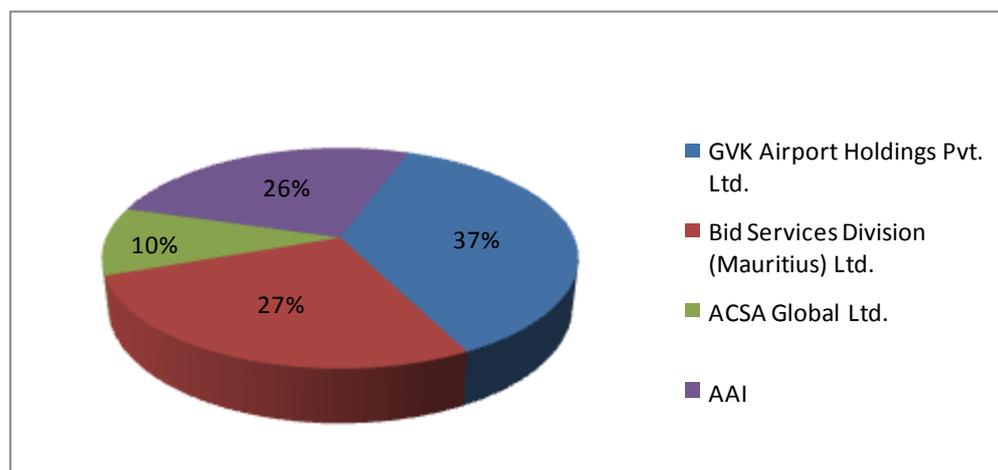
The concession for Chhatrapati Shivaji International airport is a part of the process that the Indian Government has been implementing under the auspices of the AAI to privatize the Indian airport system which follows a world wide trend that began in the 1980's in the U.K and gathered increasing momentum throughout the world aviation industry.

AAI shortlisted 9 private sector consortia to participate in the bidding process out of which six consortia submitted their technical and financial bids for Delhi & Mumbai. On January 31, 2006, the bids of the shortlisted consortia were opened and based on the evaluation process followed by AAI, the GVK-led consortium was selected as the successful bidder for Mumbai Airport. The GVK led consortium, Mumbai International Airports Limited (MIAL), a Private Limited Company under Indian Companies Act, was entrusted to develop and operate the Airport under PPP mode for a period of 30 years and was allotted land of 800 Hectares at Mumbai. The consortium partners of MIAL are shown below:

Table- 2:

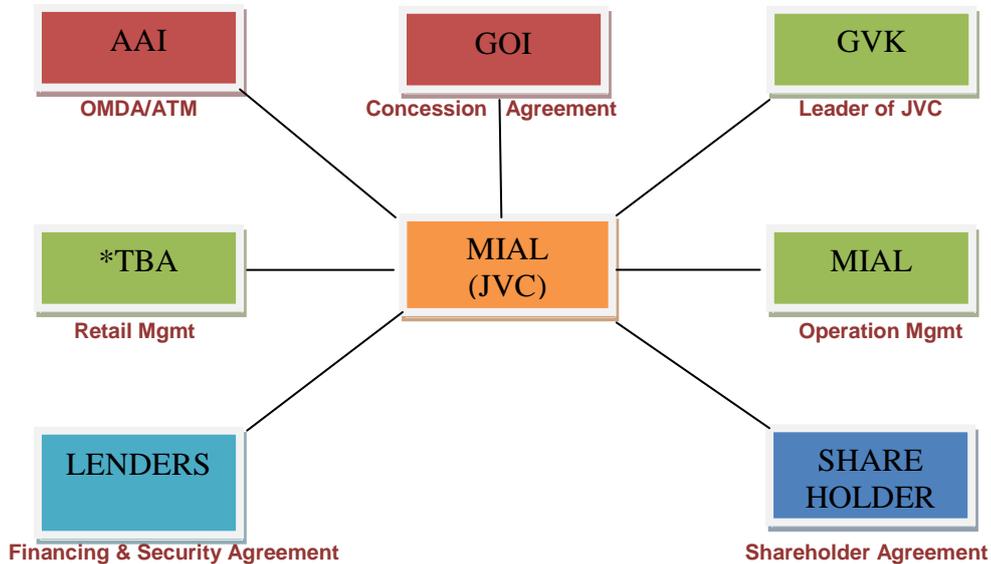
| Sr. No. | Shareholder | Percentage Shareholding |
|---------|--|-------------------------|
| 1 | GVK Airport Holdings Pvt. Ltd. | 37% |
| 2 | Bid Services Division (Mauritius) Ltd. | 27% |
| 3 | ACSA Global Ltd. | 10% |
| 4 | AAI | 26% |

In order to develop the Brownfield airport, an Operation, Management and Development Agreement (OMDA) was signed between Airports Authority of India and Mumbai International Airport Pvt. Limited (MIAL) on 4th April 2006. A State support Agreement between the President of India on behalf of Government of India and Mumbai International Airport Pvt. Limited was signed on 26th April 2006. The % age of share of the partners in the Consortium can be depicted as follows:



The legal framework of the Consortium can be depicted as below:

The Legal Framework



*To be Appointed

With reference to imposition of development fee (DF) at Mumbai International Airport, the capital expenditure incurred in construction of the same came up for examination of Airports Authority of India (AAI). Airports Authority of India (AAI) vide their letter no. AAI/MC/JVC-03/IA/2011-12/1620 dated 21-10-2011 appointed EIL as Technical Auditor for carrying out Audit of MIAL's mid term review of Project estimates.

2.0 PROJECT DETAILS & SCOPE OF WORK

The Brownfield airport covers an area of 800 Hectares. MIAL submitted Master Plan in October, 2006 along with Major Development Plan and subsequently, the revised Master Plan was submitted on 21st May, 2007 and Major Development plan for terminals was submitted on 8th November 2007. The chief objectives of the master plan were to achieve a scheme that would meet the forecast traffic for the 20 year forecast horizon, achieve the maximum processing ability of the site available. In MDP, Mumbai International Airport Pvt. Ltd. (MIAL) has developed specific plans for expansion and modernization in the short term, and an entirely New Common User Terminal in the long-term. The facilities are planned to provide flexibility to accommodate future expansions as needed. The following terminal developments are planned in a concurrent manner spanning, in two parts, the time from 2007 till 2012.

Part I: Terminal Building Works 2007 – 2010
 - International Terminal Modification and Expansion.
 - New Domestic Terminal.

Part II: Terminal Building Works 2008 – 2012
 - New Common User Terminal at Sahar

The master plan was generated using a rigorous and re-iterative selection process in order to provide the optimal and customised solution specific to the existing site conditions. Master Plan of the Airport includes provision of the following Mandatory Capital Projects:

- New high speed exit taxiway from runway 09/27
- International cargo terminal
- International car park expansion
- New international terminal access road
- Realign domestic terminal access road
- Realign taxiway B1 to code F offset dimension from runway 09/27
- Modify international stand off positions
- Domestic apron expansion
- International terminal expansion
- New domestic terminal
- International apron expansion
- New domestic terminal car park
- International remote parking bays (by AAI)
- Link Taxiways to new hanger area
- Parallel taxiway to runway 14/32
- Extension and modification of terminal 1 B
- Resurfacing of secondary runway
- Modification of existing bridge
- Crash fire tenders
- Extend taxiway B3 to runway 27 end
- Rapid exit taxiway
- Provision of in-line X-ray baggage scanning system
- Additional remote parking bays to provide for peak stand demand prior to completion of major terminal development
- Modification & extension of terminal 2B including widening of flyover of terminal-II and modification of car park, provision of walkways, escalators etc.
- Upgrade general aesthetics of all terminals
- Upgrade signage within all terminals
- Upgrade flight information and PA system
- Improve passenger amenities and services within all terminals
- Upgrade retail offerings within all terminals
- Public information display system in all terminals
- T1 (A/B) and T2 (A/B/C) traffic improvement scheme

Development of the airport had been planned to be in Phases depending upon the growth in traffic figures projected to be handled by the Airport.

The major works of Airport as per Master Plan 2011 includes the following:

- New Taxiways
- Upgradation and construction of Parallel Taxiways, Rapid Exit Taxiways (RET) and connections for Runways.
- New Common User Terminal 4,50,000 Sq. m. floor space (designed to cater for 40 million passengers annually in 2015) having raft foundations with all civil, structural and finishing works and double basement with utilities. The salient features of NCUT and associated works are shown below:
 - 4 terminal floor levels and 4 Piers
 - International Air Transport Association (IATA) Level of Service (LOS) "C"
 - 188 Check in counters
 - 20 transfer baggage re-check-in positions
 - 10 baggage reclaim belts of average 90 meter length of which 4 D/I 'swing belts'
 - 12 Customs 'green channel' & 'red channel' screening positions
 - Centralized baggage handling system
 - 60 outbound and 72 inbound immigration counters
 - 6 Chillers each of capacity 2300 TR capacity
 - MLCP for 5200 cars (approx)
 - Private vehicles, taxis and buses separated
 - Retail and food and beverage facilities of international standards
 - 41 Automated Walkways (Travalator), 73 Elevators and 47 Escalators
 - 25 Fixes Boarding bridges & 52 Passenger Boarding bridges

i) AMALGAMATION OF T2 B & C- ARRIVAL



BAGGAGE RECLAIM

ii) N55C- T2 APRON



iii) SOUTH WEST PIER



iv) SOUTH WEST PIER



v) NCUT- NEW COMMON USER TERMINAL



vi) N55B- BHS WORKS IN PROGRESS



vii) NCUT- WORKS ARE IN PROGRESS AT STATUE AREA



viii) ATC TOWER



ix) SAHAR ACCESS ROADS FOR T2- WORKS ARE IN PROGRESS:



3.0 EIL's APPROACH METHODOLOGY FOR AUDIT

- 3.1 Comparison of actually implemented and scheduled facilities with provisions in Master Plan, Major Development Plans, any relevant agreements with GOI/AAI and generally accepted best practices
- 3.2 Comparison of Timelines as per OMDA
- 3.3 Determination of cost over- runs in terms of technical specifications, variation in scope of work in view of operational requirement and escalation if any
- 3.4 Assessment of optimum plans from various possible technical alternatives
- 3.5 Assessment of utilization of Project Management Techniques effectively for all the components
- 3.6 EIL's team has studied the following documents furnished by MIAL.
 - (i) Master Plan and Major Development Plan
 - (ii) Concessionaire Agreement & its Amendments
 - (iii) State Support Agreement
 - (iv) Delegation of Powers
 - (v) Specifications
 - (vi) Drawings of key components
 - (vii) Break up of initial Project Cost
 - (viii) Break up of Project Cost as on 31.07.11
 - (ix) Contract Document for M/s Larsen & Toubro Ltd.
 - (x) Runway & Taxiway and Passenger Terminal Building
 - (xi) Quantities calculated for estimating the project cost to completion
 - (xii) HVAC,
 - (xiii) Audited Annual Report
 - (xiv) Overall Project Schedule, Monthly Progress Reports
 - (xv) Quality Assurance System
 - (xvi) Commercial, Contracts and Procurement Management Manual as per ISO 9001:2000

4.0 ASSESSMENT OF PROJECT IMPLEMENTATION WITH RESPECT TO MASTERPLAN, MDP ETC.

The Project implementation plans, timelines were developed generally in line with the requirement of approved master plans, major development plans and generally accepted best practices. Some variations have been observed during technical audit and are indicated as follows:

4.1 Area of New common User Terminal (NCUT-T2):

As per MDP 2007 (Page No. II-4) & Master Plan 2007 (clause no. 5.6) - The area of new Terminal Building T2 was 420,000 Sqm (\$450,000 Sqm) to cater to 40 million passengers per annum (Constrained by cross runway configuration).

[\$: Figure within parenthesis included arrival Plaza area.]

Deviation from MDP 2007: However, the actual area as per calculation from the latest drawings is approximately 4, 08, 433 Sqm (4, 53,357 Sqm) and the integrated area of Multi Level Car Parking (MLCP) is 2, 06,759 Sqm.

It may be noted that out of total area of 4, 53,357 Sqm, the MIAL is constructing 4, 39, 512 sqm only in (Phase I, II & III) and the balance area of 13,845 sqm which is part of South East pier (SE Pier) has not been planned to be constructed at this point of time. The cost of balance area of SE Pier has not been included in the initial cost estimates of ₹ 9802 crores.

Floor wise area Break ups:

Table - 3:

| Level | Area (sq.m) | |
|--|-----------------|---------------------|
| | As per Drawings | As per MDP (2007) # |
| Level 4 (International. Dep.) | 76,702 | 89,964 |
| Level 3 (Domestic Dep.) | 1,04,076 | 1,02,676 |
| Level 2 (Arrival) | 1,03,002 | 98,573 |
| Level 1 (Transp. Lobby & Bus gate Lounges) | 1,24,653 | 1,29,684 |
| Total Terminal Area | 4,08,433 | 4,20,897 |
| Arrival Plaza area* | 44924 | 30,000 |
| Total Area | 4,53,357 | 4,50,897 |
| Departure Kerb** | 21467 | |

Area as calculated by MIAL internally based on drawings developed during MDP preparation.

*Arrival area includes Ground Transportation Level, Vertical Cores & Arrival Plaza.

**Departure kerb with Headhouse Roof extends over Departure bay.

4.2 Aircraft Parking Stand:

As per MDP November 2007 (Clause No. 5.7) the following status for T2 stands are given below:

- a. Contact Stand: 30 (Code D & E- 25nos. + Code C= 1no. + Code F= 4Nos.)
- b. Remote Stand (Wide body aircraft): 9
- c. Remote Stand (Narrow body aircraft): 5

Deviation from MDP 2007: When T2 is fully commissioned by 2014 (including Domestic Operations) the actual status for T2 aprons are given below:

- a. Contact Stand: 25 (Code E- 23 nos. + Code F- 2 nos.)
- b. Remote Stand: 7 Code E (In SE Pier- without PBB)
- c. Remote Stand: 9 (Code E- 8 & Code F- 1)
- d. Remote Stand: 5 (Code –C)
- e. Dedicated Cargo apron at Sahar: 5 nos. (Existing) + 2nos. (Code E-1 & Code C- 1 Planned)

It may be noted that, as per MDP, T2 was designed to have 30 contact stands, whereas it has been modified into 32 stands in which 25 contact stands & 7 remote stands have been planned when T2 is fully commissioned in 2014. These 7 remote stands are to be placed in SE Pier. The cost of contact stands of 5 nos. was not included in the initial cost estimates of ₹ 9802 crores.

As discussed with MIAL, to ensure the service quality requirements as detailed in OMDA Schedule 3, to meet the requirement of 90% of the annual international passengers & 90% of the annual domestic passenger travelling through Passenger Boarding Bridges on aircraft B737/A320 or larger unless not required by Airlines. MIAL has planned T1 to remain operative with Domestic low cost carrier airlines instead of converting T1 into Cargo hub. Therefore, 11 nos of contact stands at T1 remain operational along with the 25 nos of Contact stands at T2 to meet the requirement of OMDA.

4.3 Multi Level Car Parking (MLCP):

As per MDP (Clause no 4.2) Parking is an integrated part of the New Common User Terminal at Sahar. Total facility designed for approximately 6,000 car parking spaces for the Terminal (T2).

Deviation from MDP 2007: However, the actual available space for parking as per the latest drawings accommodates only 5200 Cars (approx) due to the following reasons:

- a. A Nallah comes under the foot print of the MLCP. The area of the MLCP has been reduced since Nallah could not be completely diverted from the site.
- b. Basement sizes curtailed on either side due to utility crossings.

The cost of MLCP was included in the initial cost estimates of ₹ 9802 crores and later the project has been planned to shift to BOT basis. Hence the cost of MLCP is not included in ₹ 12380 crs.

4.4 **Apron**

As per master plan of MIAL, the following changes are mentioned below:

4.4.1 **Type C and Type E Aircraft Parking Apron:**

As per Master Plan 2007, clause no-5.6, 58, "As soon as National Airport Division (NAD) residential colony becomes available for airport development, 23 additional aircraft parking positions with associated taxiways are envisaged to be constructed for medium and large size aircraft (ICAO type C and type E). These additional aircraft stands will alleviate the requirement for overnight parking positions and additional cargo aircraft stands and will increase airport capacity. These stands can also be used as operational aircraft stand for passenger aircraft during peak periods".

Update on Master Plan 2007: The total space in NAD is approximately 54.67 Acres divided in to two pockets. As per agreements with AAI, approx 24.51 acres of present NAD Colony is proposed for Residential use, approx 1.48 acres for ATC Block and approx 2.01 acres for Met Farm.

MIAL appointed a Consultant (Landrum & Brown, USA) for the study of Passenger Terminal Apron capacity. It was concluded that the new T2 & T1 Apron was of adequate capacity to support the projected 40 mppa design day flight schedule. The provision of aircraft parking stands of T2 and T1 are found to be adequate. Hence, the apron in NAD is not required for aircraft parking use. Moreover, the distance travelled by aircrafts from the NAD is too far from T2, Cargo, and T1 facilities which may not be very suitable for the airlines also.

The cost of Type C and Type E Aircraft Parking Apron was not included in the initial cost estimates of ₹ 9802 crores

4.4.2 **Cargo Apron (proposed near Terminal 1A):**

As per Master Plan 2007, clause no. 5.6, 57 "As soon as the location of the current Indian Airlines hanger becomes available for redevelopment, the construction of six additional aircraft parking positions for cargo aircraft is proposed. These positions are directly connected to the parallel taxiway east of runway 14/32 and have access to cargo handling terminals".

Update on Master Plan 2007: The existing cargo apron is retained in the Sahar area with additional provision for two aircraft positions. It is decided to retain cargo in its current location and to use the existing apron adjacent to T1 to serve the remote stand requirements for T2.

MIAL appointed a Consultant (Landrum & Brown, USA) for study of Cargo Apron capacity. It was concluded that the new T2 & T1 Apron was of adequate size to support the projected 40 mppa design day flight schedule. There are existing five numbers of dedicated cargo aircraft parking apron in Sahar with additional provision for two aircraft parking stands. T1A apron shall continue to be used for domestic aircraft parking.

The cost of Cargo Apron (near Terminal 1A) was not included in the initial cost estimates of ₹ 9802 crores.

4.4.3 Aircraft Parking Aprons (At Gaothan areas of Phase-3):

As per Master Plan 2007, clause no. 5.6, 70 "Once all cargo facilities have moved from their existing location to their new location at the Santa Cruz side and north of runway end 14 and additional (Gotan) land becomes available for development, the existing cargo area can be redeveloped into a remote parking area. Once these additional aircraft parking positions are completed, the total forecasted required number of overnight parking bays for the ever increasing airline fleet can be met".

Update on Master Plan 2007: Since the existing cargo & its facilities have been retained in Sahar, this project is not required in present scenario and has been terminated.

At present, all the Aprons were constructed except T2 Apron which is under construction in phases.

Total area of T2 Apron is 8, 75, 000 Sqm (approx). T2 Apron (Part-1A) actual work done is 267317 Sqm in which PQC area is 1, 88, 843 Sqm and Rubblization area is 78,474 Sqm.

Table no.4 below shows the actual area breakup of Aprons.

Table- 4:

| Description | Rigid Type (PQC in Sq. M.) | Rigid Type (Rubblization Area in Sq. M.) | Flexible (In Sq. M.) | Turfing area (in Sq. M.) | Total area (in Sq. M.) |
|-------------------------------------|----------------------------|--|----------------------|--------------------------|------------------------|
| Total area of main apron (T2-Apron) | 670287 | 205255 | 0 | 23721 | 899263* |
| Night Parking Apron | 50671 | | 23355** | | 74026 |
| Apron- H | 20826 | | 24984 | | 45810 |
| T1C- Apron | 18586 | | 6535 | | 25121 |
| Total | 760370 | 205255 | 54874 | 23721 | 1044220 |

* T2 Apron Total area (Excluding Turfing) - 875542sqm

**In Flexible area consists of shoulder & perimeter road.

4.5 ATC Building (Technical Block):

As per Master Plan 2007, clause no-5.6, 36b, "It is proposed to relocate only the ATC control tower initially while the ATC Technical Block remains at its location. However, once the tower has been removed, this building will be an obstacle penetrating the transitional surface of runway 14/32 due to its height of about 37m above mean sea level. Therefore it is envisaged that the technical block will be relocated in a location north-east of the existing building outside the obstacle limitation surfaces".

Update On Master Plan 2007: The proposed location of new ATC Technical block will be in the NAD colony near RHS side of 14-end of Runway14/32.

The location proposed in the Master Plan 2007 for the future ATC Building comes in the Suthar Pakhadi area. The land of Suthar Pakhadi is under litigation. Since it is encroached, the new location for ATC Technical Block is proposed in the available land of NAD colony.

4.6 Meteorological Farm (MET Farm):

As per Master Plan 2007, clause no-4.3, "Meteorological facilities will be relocated to north-east of runway end 14" and Clause no 5.5, 62a "The Meteorological observatory and facilities will be relocated. The area is selected such that the observatory equipment will neither be disturbed by nearby structures nor by possible jet blast from aircraft passing by".

Update On Master Plan 2007: As proposed in Master plan 2007 (clause no-4.3), Meteorological farm comes within path of Runway 14/32 towards Runway 14 end and the entrance to T2 Common User Terminal (CUT) and the new elevated road is also very close to Met farm.

Hence, the Met farm is proposed to be shifted to NAD colony near RHS side of 14-end of Runway14/32.

4.7 Elevated Road access from Western Express Highway (WEH):

As per Master Plan 2007, clause no-11.2, Connection Terminal T2- Western Express Highway- "The proposed direct road connection consists of an elevated highway between the Western Express Highway and the future Terminal T2 being developed by the Civic authorities".

Update on Master Plan 2007: The alignment of the elevated road access from Western Express Highway has been shifted from north western corner of NAD colony to south of the NAD colony due to the following reasons:

- a. Vacant land is available in the new alignment.
- b. Access route is also shorter from WEH to T2.
- c. Minimize disturbance/relocations from occupied NAD colony.

- d. It is difficult to construct Grade separators due to lack of space in the existing junction profile. However, this is not a problem in the proposed new alignment.

4.8 Redevelopment of Residential colonies:

As per Master Plan 2007, clause no. 5.4, 54 “In line with the Airport Development Philosophy, residential colonies within or adjacent to airport land will be redeveloped and densified to ensure the development and growth of the airport. The MIAL staff Quarters and NAD Colony as well as other residential colonies will be reconstructed as far as possible and practical within the present MIAL/AAI colony and in consultation with the residents. Airline colonies near the Old Airport will also be redeveloped and densified to free up land for airport related activities such as aircraft maintenance hangers. The post and Telegraph residential colonies in Sahar and kalina will be combined in Kalina”.

Update on Master Plan 2007: The new proposed area for residential complex of AAI is in NAD colony.

Residential complex development for AAI is centralized and integrated in one location at NAD colony. Sufficient land is available in NAD colony for development of new integrated AAI residential colony.

Aircraft maintenance hangers will be shifted to the available area in the south of Runway 09/27 and to the New Engineering Complex (NEC) north east of Runway 14. The land under P&T colony at Sahar is not available for airport development.

4.9 Cargo Terminal at Sahar:

As per Master Plan 2007, clause no. 5.5, 59 Cargo Terminals- “As soon as the location of the current Indian Airlines hanger becomes available for redevelopment, an additional Cargo handling terminal will be constructed at this site. The date of completion of these cargo facilities will depend on the date when the required lands will be available”.

Update on Master Plan 2007: The development of cargo facilities is proposed in the existing location of International Cargo facility at Sahar, with expansion into CPWD colony, Sahar.

As proposed in Master plan 2007 (clause no-5.5, 59), the land under P&T colony is unavailable for development of Airport. The existing locations of international Cargo facilities at Sahar remain at the same location with expansion into CPWD colony.

The cost of Cargo terminal of ₹ 255 crore was included in the initial cost estimates of ₹ 9802 crore and later the project has been planned to shift to BOT basis. However, provision of ₹ 50 crore as enabling cost is included in ₹ 12380 crore.

4.10 Cargo Terminal in T1A, T1B, T1C (After Shifting of significant Domestic passengers to New T2) :

As per Master Plan 2007, clause no. 5.5, 59 "Once a significant number of domestic passengers have shifted from the existing domestic terminal in Santa Cruz to the new one roof terminal in Sahar, terminal 1B could be replaced by a state of the art air cargo handling facility for both international as well as domestic cargo".

As per Clause no. 5.6, 67 "If in future it becomes feasible to shift the remaining domestic passengers also from T1A Santa Cruz to the one-roof common user terminal in Sahar, it is proposed to replace T1A by a cargo terminal. In this way, the Santa Cruz side of the airport can completely be transformed into a dedicated air cargo village with separate road access and facilities".

Update on Master Plan 2007: The development of cargo facilities is proposed in the existing location of International Cargo facility at Sahar, with expansion into CPWD colony, Sahar.

The cost of Cargo Terminal 1A, 1B & 1C were not included in the initial cost estimates of ₹ 9802 crores.

4.11 Approach Radar:

As per Master Plan 2007, clause no. 5.4, 38 "The approach radar is presently located north of the intersection of runways 09/27 and 14/32. After the construction of new Fire Fighting and Rescue Station, the approach Radar will be moved from its present location and mounted on top of the new FF&R station".

Update on Master Plan 2007: The proposal of existing radar will be relocated to south of Runway 09/27 near Jet Airways hanger. The second radar is also required as recommended by AAI. The final location of second radar is not finalized.

For the selection of location of Radar siting study was conducted by MIAL and AAI to find out the best possible location in terms of coverage such as Common User terminal, Domestic Terminal, ATC, Cargo etc. The final location of second radar is finalized near the DVOR.

4.12 Aircraft Maintenance Facility, Aircraft Maintenance Hangers and Aircraft Maintenance Area:

As per Master Plan 2007, Aircraft Maintenance Hangers- clause no. 5.5, 50 "To rationalize land use and increase airport capacity, all existing aircraft maintenance hangers north of runway 09/27 need to be removed or relocated. If and when required by airlines, the construction of new aircraft maintenance hangers could be facilitated in the area of south of runway 09/27, west of runway end 32".

Aircraft Maintenance Facility- clause no. 5.5, 68 "After the encroached airport land southwest of Runway 09/27 is rehabilitated, additional aircraft maintenance facilities can be constructed. This facility could comprise of a new apron, aircraft maintenance hangers and a ground support maintenance facilities".

Aircraft Maintenance Area- clause no. 5.5, 71 "In the Ultimate development phase, the aircraft maintenance area could be expanded parallel to west of runway end 32. This development is subject to the relocation of the existing residential colonies".

Update on Master Plan 2007: The new proposed location of aircraft maintenance hangers will be in the available area south of Runway 09/27 and to the New Engineering Complex (NEC) north east of Runway 14.

As proposed in Master plan 2007 (clause no-5.5, 50,68 &71), these facilities come in south west of Runway 32 end including some portion in Air India residential colony in Kalina. Due to unavailability of contiguous airside land and existing Air India residential colonies (under occupation), it is proposed to shift these facilities in available area in the south of Runway 09/27 and to the New Engineering Complex (NEC) north east of Runway 14.

The cost of this project was not included in the initial cost estimates of ₹ 9802 crs. However, ₹ 205 crs has been included in the project cost of ₹ 12380 crs.

4.13 Right of Way for Metro Connection:

As per Master Plan 2007, clause no. 5.4, 47 "A new metro line is presently being constructed above the Andheri Kurla road. By reserving the right of Way, a possible future connection to the New Terminal Building in Sahar is made possible".

Update on Master Plan 2007: Metro connectivity is proposed from Bandra Kurla Complex/Mahim to T2 and the future connectivity to SEEPZ/Powai through Andheri-Kurla road to be developed as per the extended Metro line 3 by MMRDA.

4.14 Project Cost

As per MDP 2007, the project cost projected in page no. I-14, I-22 & II-50 includes the Modification, Upgradation and Construction of Terminals and associated works excluding Airside works. But, the initial cost estimates submitted by MIAL for the Project was earmarked as ₹9,802 Crores. However due to the additional projects the cost has got increased to ₹10,453 Crores as on October 2010. Later due to delay in handing over related area for construction the schedule of project got extended by 17 months and also some addition of new projects, the project cost is revised to ₹12,380 crores. The revised Project cost worked out by MIAL and submitted to AERA is ₹12,380 Crore.

Table no. 5 below shows the Project cost shown in MDP, Project cost as on October 2010 and Revised Project Cost Submitted by MIAL.

PROJECT COST

Table- 5:

| S No | Project Cost (T2, T1 & Airside) | Project Cost As Per MDP (₹ In Crore) | Project Cost As Per Jan 2009 (₹ In Crore) | Revised Cost-I As On Oct 2010 (₹ In Crore) | Revised Cost-II as on 2011 (₹ In Crore) |
|----------|--|--------------------------------------|---|--|--|
| 1 | T2- Projects | | | | |
| | T2-Completed Cost | - | 56 | 55 | 52 |
| | T2 Projects – Amalgamation of T2B & C | 229 | 170 | 170 | 168 |
| | T2- Enabling Work | 239 | 352 | 401 | 391 |
| | T2- NCUT | 3715* | 3236 | 3562 | 4089 |
| | T2 –SWP | 434** | | | |
| | T2- New Sahar Terminal access Roads | 250 | 250 | 350 | 350 |
| | T2-MLCP | 270 | 270 | Nil | Nil |
| | T2- Police station | Nil | 3 | 6 | 8 |
| | T2-STP | Nil | Nil | 25 | 25 |
| | Hard Cost – T2 Projects | 5137 | 4337 | 4569 | 5083 |
| 2 | T1 Projects | | | | |
| | T1-Completed Cost | Nil | 78 | 80 | 80 |
| | T1-New Domestic Terminal T1C | 247 | 224 | 224 | 227 |
| | T1- Renovation & Upgradation of T1A | 115 | 96 | 93 | 92 |
| | T1- T1C hotel | Nil | Nil | 26 | 54 |
| | Hard Costs-T1 Projects | 362 | 398 | 423 | 453 |
| | Total Hard cost of T1 & T2 projects (excluding Tech Services & Consultancies fees, Contingency & soft cost) | 5499 | 4735 | 4992 | 5536 |
| 3 | Airside Costs | | | | |
| | Airfield (Runway, Taxiways, etc) | Nil | 1164 | 1,418 | 1,545 |
| | Apron | Nil | | | |
| 4 | Landside Project | Nil | 41 | 41 | 41 |
| 5 | Misc. Projects (ATC Tower, GAT, AMB, Cargo Terminal, NACIL, BMC, Yellow Fever, GSE, BCAS, etc.) | Nil | 471 | 579 | 562 |
| 6 | 5.4 of OMDA (AAI works taken over) | Nil | 24 | 24 | 24 |
| 7 | Soft Costs | | | | |

| S No | Project Cost (T2, T1 & Airside) | Project Cost As Per MDP (₹ In Crore) | Project Cost As Per Jan 2009 (₹ In Crore) | Revised Cost-I As On Oct 2010 (₹ In Crore) | Revised Cost-II as on 2011 (₹ In Crore) |
|------|--|--------------------------------------|---|--|---|
| | Pre- Operative Cost | 596.3*** | 415 | 479 | 684 |
| | Capitalized Interest | | 1632 | 1069 | 1410 |
| | Total Soft Cost | 596.3 | 2047 | 1548 | 2094 |
| 8 | Technical Services & Consultancies (Fees) | 286.1*** | 732 | 743 | 834 |
| 9 | Capital expenditure for operations | Nil | 118 | 118 | 118 |
| 10 | Upfront Fee paid to AAI (as per OMDA) | 150 | 150 | 154 | 154 |
| 11 | Additional Projects | | | | |
| | New ATC equipment cost and Technical block in NAD colony | Nil | Nil | 310 | 310 |
| | Contribution to MMRDA for Sahar Elevated Road | Nil | Nil | 166 | 166 |
| | WHSS- Shivaji Smarak/ Memorial | - | - | 25 | 25 |
| | Mithi River realignment | - | - | 150 | 150 |
| | New RET N5 | - | - | - | 29 |
| | New RET E2 | - | - | - | 22 |
| | Enabling Cost for taking over carved out assets (NAD Colony) | - | - | - | 110 |
| | Cost of settlement of Land | Nil | Nil | Nil | 30 |
| | Total Additional Cost | Nil | Nil | 651 | 842 |
| | Project Cost | 6,531.40 | 9,482 | 10,268 | 11,750 |
| 12 | Escalation & Contingency | 286*** | 320 | 185 | 630 |
| | Total Project Cost | 6,817.40 | 9,802 | 10,453 | 12,380 |

* MDP cost ₹4234.70 Crs includes the cost of terminal, landside, access road & MLCP (4235-250-270= ₹3715 Crs)

** MDP cost ₹489.3 Crs which includes cost of access ramp & 3 gate expansion (489.3-31.47-24= ₹434 Crs)

*** Component for Airside cost not included.

4.14.1 It may be noted that, the revised project cost – I & II doesn't include the cost component of MLCP, IT System and International cargo expansion since all are under BOT basis. Fuel hydrant system and security system cost also not incurred in project cost.

4.14.2 The Break up of Enabling cost of T2 is attached in Annexure III

5.0 COST OVERRUN IN TERMS OF CHANGE IN TECHNICAL SPECIFICATIONS, CHANGE IN SCOPE, QUANTITY VARIANCE AND PRICE VARIANCE:

5.1 Apron

5.1.1 T2-Apron area as per MIAL's estimate is approx. 8.75 Lakh Sq. M., whereas the works done for T2 Apron part-1A is 267317 Sq. m. (including rigid & rubblised area).

5.1.2 The cost estimate of ₹ 658 Crores shown by MIAL seems to be reasonable. The table no. 6 below shows the cost of T2 aprons.

Table-6:

| Item | UOM | Quantity | Rate | Amount (INR in Crs) |
|----------------------------------|-------------|---------------|-------------|---------------------|
| Completed - T2- Apron (Part 1A) | Sq M | 267317 | 7515 | 200.90 |
| Balance Work (Area of T2- Apron) | Sq M | 608225 | 7515 | 457.10 |
| Total T2-Apron | Sq M | 875542 | 7515 | 658 |

5.1.3 *Same per sqm rate considered for both completed & Balance work of T2-Apron. The per sqm rates include the cost of drain work, rubblisation, enabling work, excavation, miscellaneous works, contractor profit (17.14%), site overheads (4%) & VAT (5%).

The rates verified by Technical Auditor are based on Detailed BOQ provided by MIAL, MoRTH Guidelines and prevailing rates of material in Market.

5.2 Rehabilitation & Upgradation of Runways:

As per Master plan 2007, Upgradation of runways and taxiways to Code-F aircraft is considered in a phased manner as required by OMDA. MIAL had awarded the works to M/s L&T for both the runways.

5.2.1 09-27 Runway

i. Existing Runway 09-27 is the main runway at CSIA, Mumbai. It is a code E runway with 45m full strength section of pavement with 15m wide shoulders, extending for a length of 3450m. This runway has been enhanced to accommodate the forecasted traffic at CSIA, including the new large Code F Airbus 380. For Code F compliance, the following major works has been done.

- Widening of full strength pavement from 45m to 60m.
- The intersection with the crossing runway has been re-profiled and the centre line is modified
- Additional taxiway links to the runway to provide additional taxi access has been constructed.

- Existing drain got demolished and new drainage system extending the length of the runway has been provided.
 - Runway edge light has been shifted by 7.5m in accordance with new 60m wide runway.
 - Approach lights has been replaced and sequential flash lights on both ends of the runway is upgraded.
 - New ductbanks and AGL circuit has been completed and upgraded to CMS system.
 - Navigational aids including localizer, glide path & PAPI's has got shifted.
- ii. The cost shown by MIAL in the cost report is ₹ 175.43 Crore. As per TA the cost for Rehabilitation & Upgradation of 09-27 Runway seems to be reasonable.
- iii. The cost verified by Technical Auditor is based on Detailed BOQ provided by MIAL, MoRTH Guidelines and prevailing rates of material in Market.
- iv. Rehabilitation & Upgradation of 09-27 Runways has been completed by 31st May 2011.

5.2.2 14-32 Runway

- i) Existing Runway 14-32 is the secondary runway at CSIA, Mumbai. It s a code E runway with 45m full strength section of pavement with 7.5m wide shoulders, extending for a length of 2871m. This runway has been enhanced to accommodate the forecasted traffic at CSIA, including the new large Code F Airbus 380. For Code F compliance, the following major works has been done.
- Widening of shoulders from 7.5m to 15m.
 - The longitudinal grade and transverse slope of runway has been re-profiled.
 - New section in rigid pavement at the start of runway 32 end (approx. 750m) has been constructed due to bad subgrade.
 - Additional taxiway links to the runway to provide additional taxi access has been constructed.
 - Existing drain got demolished and drainage system has been modified.
 - Runway centerline light has been installed.
 - Approach lights have been upgraded both ends of the runway.
 - New duct banks and AGL circuit has been completed and upgraded to CMS system.
 - Navigational aids, RVR & PAPI's have got shifted.
- ii) The cost shown by MIAL in the cost report is ₹ 129.34 Crore. As per TA the cost for Rehabilitation & Upgradation of 14-32 Runway seems to be reasonable.
- iii) The cost verified by Technical Auditor is based on Detailed BOQ provided by MIAL, MoRTH Guidelines and prevailing rates of material in Market.

iv) Rehabilitation & Upgradation of 14-32 Runway has been completed by 08th April 2010.

5.3 Taxiways

5.3.1 As per Master plan 2007, Rapid exit taxiways, full length parallel taxiways, connecting taxiways are envisaged for optimising the ground circulation of aircraft. The added taxiways will help to maximize runway capacity at CSIA by improving aircraft circulation and reducing runway occupancy time.

5.3.2 Upgradation of taxiways to accommodate Code-F aircraft is considered in a phased manner as required by OMDA. Upgradation/new taxiway including RET's has been constructed to compliance Code F. The table no. 7 below shows the actual cost worked out by Technical Auditor.

5.3.3 The cost shown by MIAL in the cost report is ₹ 292.31 Crore.

**Taxiway N43B-II will be constructed after shifting/demolition of existing ATC Tower for (which is in close proximity to the taxiway) Code-E compliance of taxiway. New ATC tower completion was scheduled in month of January 2013 and after completion it will take minimum six months for full commissioning of new ATC tower. After demolition of ATC tower only, the taxiway N43B-II works may be initiated from August 2013 and must be completed before domestic operations in terminal T2, scheduled for August 2014. Hence, the cost of 32.34 Crores has not been incurred yet and should not be included in Project cost at this point of time. The same can be considered by Competent Authority for levy of DF only after commissioning of above works. Please note that, for widening of parallel taxiway (N43B-II) to Code-F compliance, Technical block will have to be relocated.

Table - 7:

| Item | UOM | Quantity | As per MIAL | As per Technical Auditor | |
|----------------------------------|------|----------|---------------------|--------------------------|----------------------------|
| | | | Amount (INR in Crs) | Amount (INR in Crs) | Remarks |
| Taxiway (S006) | Sq M | 137650 | 103.29 | 103.29 | All projects are completed |
| Taxiway (N33A) | Sq M | 77640 | 42.59 | 42.59 | |
| Taxiway (66) | Sq M | 39131 | 23.78 | 23.78 | |
| Taxiway (N43A) | Sq M | 89648 | 53.40 | 53.40 | |
| Taxiway (N43B-I) | Sq M | 29483 | 69.25 | 36.91 | |
| Taxiway (N43B-II) | Sq M | **48104 | | - | **Yet to be awarded |
| Total Impact (INR in Crs) | | | 292.31 | 259.97 | 32.34 |

*These taxiways cost includes with drain work, enabling work, excavation, duct bank miscellaneous work, contractor profit (17.14%), site overheads (4%) & VAT (5%).

The cost verified by Technical Auditor is based on Detailed BOQ provided by MIAL, MoRTH Guidelines and prevailing rates of material in Market.

5.4 ATC & Associated Works

- 5.4.1 As per Master Plan, the existing ATC tower will be relocated to allow for construction of a parallel taxiway to Runway 14/32. The new control tower is under construction in the landside of Santa Cruz area in front of T1C. Related taxiway portion towards east of Runway 14/32 will be constructed after the relocation of ATC tower, which will be able to cater to Code E aircrafts with the existing technical block in the current location. However, for widening of parallel taxiway to Code F compliance, Technical block will have to be relocated. The proposed location of new ATC Technical block will be in the NAD colony near RHS side of 14-end of Runway14/32.
- 5.4.2 Total height of ATC tower is 83.8 meter. The structure cost of ATC tower is ₹ 80 Crores. Overall progress of new ATC has been achieved around 78% by end of July 2012. The scheduled completion of the new ATC tower is January 2013 and progressive handing over of the work fronts to AAI for installing the equipments to be commenced by 1st November 2012. There is a provision of ₹110 Crores (Refer Annexure-IV) for AAI letter no.- AAI/MC/MIAL/-12/MISC/2010-11/290 date 26thJuly'10) for procuring and installation of the equipments. After the new ATC tower becomes operational, the existing tower will be demolished.
- 5.4.3 Since the schedule for construction of Technical block & associated works are not finalized till date, the cost of ₹ 200 Crore should not be included in Project cost at this point of time. The same can be considered by Competent Authority for levy of DF only after commissioning of Technical block & associated works.

5.5 Terminal Building T2

As per MDP, the area of new Terminal Building T2 was 420,000 Sqm (450,000 sqm) to cater to 40 million passengers per annum (Constrained by cross runway configuration). However, the actual area to be constructed by MIAL is 4, 39,512 Sq. m. (Technical Auditor has verified and accepted as shown in Table No. 3 of this report).

It is stated by MIAL that 4, 39, 512 sqm only in (Phase I, II & III) are being constructed and the balance area approx 13,845 sqm which is part of South East pier (SE Pier) has not been planned to be constructed at this point of time.

As per MDP 2007, the enabling work of T2 was ₹ 239 Crores. As per revised project cost submitted by MIAL, the enabling cost got increased to ₹ 399 Crores

Table no. 8 below shows the Project cost shown in MDP, Revised Project Cost Submitted by MIAL & Cost worked out by Technical Auditors.

Table - 8:

| T2 Project Cost | As Per MDP 2007 | As Per MIAL | As per Tech. Auditor |
|---|-----------------|-------------|----------------------|
| Completed Cost- (A) | - | 52 | 52 |
| S009 – Amalgamation of T2 B & C | 229 | 168 | 168 |
| S009- South-west pier | 434 | 4114 | 4114 |
| N55B – New common user terminal | 3715 | | |
| N046- New sahar terminal access road | 250 | 350 | 350 |
| N048 – MLCP T2 | 270* | - | - |
| Total Cost (₹ In Crore) - (B) | 4898 | 4632 | 4632 |
| Enabling Works of T2 | | | |
| E001-T2A Access ramp | 31 | 31 | 31 |
| E010-T2C additional PBB (3 nos) | 24 | 24 | 24 |
| E002-Demolition of T2A | 183 | 12 | 12 |
| E003-Demolition of Central ramp | | 1 | 1 |
| E007-Apron H expansion | | 21 | 21 |
| E011-Placement of slab in mezzanine floor | | 3 | 3 |
| E012- T2 B & C interim parking (Temp. MLCP) | | 42 | 42 |
| E013- T2 interim Taxi parking | | 4 | 4 |
| E014- T2 B/C landside road work | | 31 | 31 |
| E016-Airside gate 6 service road | | 3 | 3 |
| E022-Line maintenance facility relocation / demolish existing apron control tower | | 12 | 12 |
| E027-CCR building relocation | | 16 | 16 |
| E004-Relocation of Shivaji statue | | 3 | 3 |
| E006-Relocation of Project office | | 18 | 18 |
| E008-Relocation of Air India hanger | | 12 | 12 |
| E009-Relocation of water pumps, towers, utilities | | 75 | 75 |
| E017-Air India Facilities (ROFS) | | | |
| E018-Centralized kitchen relocation (AI) | | | |
| E019- AI GSD relocation (GSE/transport/U LD) | | 2 | 2 |
| E021-Misc Demolition & E005-Temple relocation | | | |
| E024 & E025-Multiphased T2 site access roads | | 49 | 49 |
| E026-Demolition of sump & relocation of utility | | 10 | 10 |
| E028-Demolition of T2 B&C | 22 | 22 | |
| Police station | | 8 | ** 7.4 |
| Total Enabling cost (₹ In Crore) - (C) | 238 | 399 | 398.4 |
| Total Cost of T2 project (₹ In Crore) - (A+B+C) | 5136 | 5083 | 5082.40 |

* MLCP is considered under BOT project.

** ₹ 0.6 cr has to be deducted from project cost since it has been paid as penalty for the delay in getting clearance from MMRDA.

5.6 T1 C Hotel

- 5.6.1 As per master plan 2007, in the city side facilities, it had been mentioned that airport related facilities such as a hotels, conference centers and offices are located near the terminals. However it is not clear whether the development is for T1 or T2.
- 5.6.2 After the completion of NCUT by 2014, the major domestic airlines will be operating from NCUT. Hence the city side facility like Hotel is required for T2.
- 5.6.3 Approval cost of T1C hotel (Structure cost only) as on Oct 2010 was ₹ 26 crs and the cost got revised to ₹ 54 crs. MIAL is planning to handover the hotel to concessionaire to complete the furnishing and interior and operate. From this it is understood that, MIAL will be receiving revenue from concessionaire once it starts operating and also it has access from landside and from terminal. Hence the cost of T1C hotel shouldn't be included in the project cost. However, the same can be considered by Competent Authority for levy of DF

5.7 Upfront Fee Paid to AAI

- 5.7.1 As per OMDA clause no 11.1.1, "the JVC shall pay to AAI an upfront fee of ₹ 150 Crore on or before the effective Date. It is mutually agreed that the upfront fee is non-refundable and payable only once during the term of this agreement". The revised cost of upfront fee is ₹ 153.85 Crore.
- 5.7.2 The increase in upfront fees by ₹ 3.85 Crs to AAI is due to the requirement of additional land of 48.15 acres for development of convention centre (16 acres), ATC tower complex (2.98 acres), NAD colony (25 acres) and ATC technical block & associated works (4.17 acres). Refer Annexure V for the approval letters for the same.
- 5.7.3 As per state support agreement- clause no 3.1.1, it is clearly stated that "the upfront fee payable by JVC to AAI under OMDA shall not be included as part of costs for provision of Aeronautical Services and no pass-through would be available in relation to same".

5.8 RET E2 & N5

RET E2 & N5 are the new project added in the project cost estimate. In estimation sheets for the construction of RET from N5 (Taxiways) 10% of has been taken for AGL, but at the same time for RET E2 is also in progress & 15% has been kept for AGL. The difference of ₹ 0.75 crores is overestimated. Hence, it should be excluded from project cost.

5.9 Shivaji Memorial

- 5.9.1 The Shivaji statue was falling in the footprint of the new common user terminal. For shifting the statue to new location, MIAL has been mandated to bear the cost of construction of the memorial. The cost estimated for the same is ₹ 25 Crores, which is a preliminary estimate and seems to be reasonable. The copy of the letter of Government of Maharashtra (GOM) has been attached (Refer Annexure VI). Authority may take appropriate decision on construction cost of memorial to include or exclude from project cost.

5.10 Realignment of Drain below the forecourt road

The proposal for realignment of Drain had been finalized by MCGM and the construction is in progress. Drain had to be covered in 8 locations for CSIA due to following reasons.

| S. No. | Description | Remarks |
|--------|--|--|
| 1 | Rerouting of drain along carriage way C1 | Rerouting of drain was essential for construction of proposed at-grade road (DP road) as part of Elevated Road system. (The down ramp of elevated road retaining wall will falls at the existing drain alignment and blocks the existing DP road.) |
| 2 | Drain cover at C8 | Culvert widening is necessary for entry to new MLCP |
| 3 | Drain cover at C5 | Covering of drain at C5 is required for movement across gate No 6 |
| 4 | Drain cover at C6 | Covering of drain at C6 is required for entry to Utility Building Area |
| 5 | Drain cover at C2 & 3 | Covering of drain is required for movement of construction vehicle facilitating construction phasing |

The estimation for the realignment of Drain was ₹ 106.15 Crores (including covers of drains) against the original cost of ₹ 76.69 Crores and there was a difference of cost of ₹ 29.46 Crores from the original estimate of MCGM. Hence, an agreement (Refer Annexure-VII) was signed between MCGM & MIAL to bear the increase in cost plus 10% contingency of the same by MIAL.

The total estimated cost for the cover section is ₹ 35.29crs which has to be constructed for the purposes explained in the above table. While, MIAL has to bear only a cost of ₹ 33 Crores as per the agreement signed. As per the Auditor, the cost to be paid by MIAL to MCGM seems to be reasonable.

5.11 NAD Colony Development

The total space in NAD is approximately 54.67 Acres divided in to two pockets. As per agreements with AAI, approx 24.51 acres of present NAD Colony is proposed for Residential use.

The schedule for construction of NAD colony & associated works are not finalized till date, the cost of ₹ 110 Crores should not be included in Project cost at this point of time. The same can be considered by Competent Authority for levy of DF only after commissioning of NAD colony development.

5.12 Cargo Terminal at Sahar

The cost of Cargo terminal of ₹ 255 crs was included in the initial cost estimates of ₹ 9802 crores and later the project has been planned to shift to BOT basis. However, provision of ₹ 50 crs as enabling cost is included in ₹ 12380 crs. As per RFP, the cost incurred in this project will be refunded by the BOT concessionaire. Hence, the cost of ₹ 50 crs should not be included in the project cost.

The Cost incurred for MCP work (International Cargo Terminal S-002,) was ₹10 Crs which has to be part of project cost (completed on March 2008) because the cargo need

to be demolished for construction of proposed Taxiway E and perimeter road, which are planned to be constructed after demolition of existing ATC Tower.

5.13 Landside Projects

The projects involved in the landside are mandatory capital projects of OMDA which are Realign of Domestic Terminal Access Road (S-005) and New Domestic Terminal Car Park (S-012). The total cost of landside works is ₹40 Crores, which seems to be reasonable.

5.14 Mithi River Realignment

Government of Maharashtra (GOM) letter no. BRIMSTOW AD-07/UD-2 dated 7th December 2007, the recommendations of Chitale Committee to widening of the waterway below the runway for preventing flood like situation at CSIA, Mumbai. The widening of the Runway Bridge for 40m from at present 27m waterway is extremely essential to avoid any obstruction to the flow of Mithi River and consequent flooding in and around the Airport.

The upstream part of Mithi River is widened to 35-40m and downstream part of the river is widened to 100m width by Municipal Corporation of Greater Mumbai (MCGM) as per recommendation by Central Water and Power Research Station (CWPRS) and FFC.

MIAL had appointed IIT, Powai to study hydraulics of Mithi River within CSIA and advice on increase in river flow within CSIA. IIT, Powai has suggested two box culverts of 12m each clear width (24m with minimum depth 4.1m & length 439m) for additional channel and area by side of the existing 27 m wide bridge alignment.

The additional channel of Mithi River are affecting the perimeter road and lights, drain, site grading, Blast fence, boundary wall, relaying of pavement works and AGL works, etc. MIAL will have to complete the additional channel to the Mithi River in Airport premises prior to the 2012 monsoon season. The realignment work of Mithi River completed as per scheduled by 31st May 2012.

The widening of Mithi River along with the enabling works at Airport premises preventing the floods on airside & the cost of construction of the Mithi River is ₹ 150 Crores, which seems to be reasonable.

5.15 Escalation & Contingencies

5.16.1 Escalation & Claims: MIAL estimated ₹250 Crs for escalation which includes delay in T2 CWP works, Elevated road, At grade road, Airside works and other miscellaneous work and ₹200 crs as claims for T2 Cost (anticipated claims), Design Service cost and EPC contractor OverHead cost (OH) due to time extension of 17 months. As per the auditor's, escalation cost estimated seems to be reasonable, whereas the cost estimated in claims, the T2 anticipated claims for idling of labour, machinery & equipment is ₹102 crs. However, the claims raised as on date by various vendors (Refer Annex-IX) other than L&T are ₹122 Crs (which are under discussion). Hence, the estimated claim ₹102 Crs shall be part of project cost.

5.16.2 Contingencies : MIAL estimated ₹180 crs for contingencies which includes power charges (testing & commissioning), Water charges, house keeping works and change orders (Civil, Structural & MEP works of T2 and Airside works). As per the auditor's, contingencies cost estimated seems to be reasonable.

5.16.3 As per Technical Auditor, the Escalation, Claims & Contingencies has to be capped at ₹630 Crs to avoid overrun of project cost.

5.16 Benchmarking Report

5.16.1 As per the Bench marking report submitted by M/s Jacobs, the Project cost benchmarked for New Terminal T-2 is US \$ 1043.6 Million (₹ 4696.20 Crore). This cost includes only New Terminal (T2), MLCP and Access roads.

5.16.2 The bench marking done is in association with five other similar types of recent International airports which are already in operation as indicated below. Table no. 9 below shows the actual cost of CSIA, Mumbai vs recent constructed International Airports.

Terminal Costs in US \$ (Conversion factor: 1 US \$ = ₹ 45)

Table -9:

| Overall Cost Parameters | BKK (Bangkok) | KUL (Kuala Lumpur) | PEK (Beijing) | LHR (London Heathrow) | MAD (Madrid) | BOM (Mumbai) | Revised Estimate of CSIA, Mumbai |
|---|---------------|--------------------|---------------|-----------------------|--------------|--------------|----------------------------------|
| Terminal design Capacity (mppa) | 45.0 | 25.0 | 43.0 | 28.0 | 42.0 | 40.0 | 40.0 |
| Floor Area (in Sq. M.) | 563000 | 479404 | 900000 | 353020 | 757000 | 407,100 | 4,39,512* |
| Total actual cost (in million US \$) | 2800.00 | 1600.00 | 3800.00 | 4100.00 | 2948.20 | 1043.60 | 1129.55** |
| Actual cost per mppa (in million US \$) | 62.20 | 64.00 | 88.40 | 146.40 | 70.20 | 26.10 | 28.24 |
| Actual Cost/m2 of GFA (in US \$) | 4973.40 | 3337.50 | 4222.20 | 11614.10 | 3894.60 | 2563.40 | 2570.00 |

*Floor Area of the Terminal including Arrival Plaza but excluding part of SE Pier.

**The cost includes New Terminal T2, enabling works and access roads.

6.0 ASSESSMENT OF POSSIBLE TECHNICAL ALTERNATIVES APPLIED TO CONTAIN THE COST OVERRUN

As reported by MIAL, there are instances of alternate approach, methods, design parameters, reduced material quantity, optimum plans used by MIAL for cost containment. A few attempts made by MIAL are shown below:

- 6.1 Clear glass instead of extra clear glass has been used for external façade of T2 processor.
- 6.2 For interior glass partition, instead of Cricursa (Spain) make similar type of glass from China has been planned to be installed.
- 6.3 For T2 GFRG, part of dichroic glass has been replaced by clear laminated glass to save cost of the project.
- 6.4 By using proto type Chandeliers, the cost components have taken down and have saved cost of the project.
- 6.5 Reconfiguration of Transformer: MIAL reduced the total requirement of Transformer from 45 to 30 nos as total load was optimized from 48 MVA to 37.5 MVA, further the configuration of Transformer was optimized by reducing the redundancy from n+n to n+1 for each substation which saved cost of the project cost.
- 6.6 Various optimization measures including change of HT cables to aluminium from copper have been taken to bring the cost component down.
- 6.7 Change of specification in BHS including height of side guards was standardized to 500mm to 350mm, reducing conveyor belt thickness to 3 mm and catwalk width to 800mm, change of make-up carousal from Stainless steel to rubber have saved cost of the project.
- 6.8 Reuse of 10nos of VDGS reduced the cost component.
- 6.9 Change of specification of SWP PBB for staircase, partial removal of shed, manual shutter operation of cab instead of electrical operation has brought down the cost component.
- 6.10 For signage, the exquisite design has been changed by prototype development to bring down the cost of project.

7.0 ASSESSMENT OF PROJECT MANAGEMENT TECHNIQUES USED BY MIAL

- 7.1 MIAL has prepared tendering/procurement flow chart for each stage relating to pre-qualification of Contractors/vendors, techno-commercial evaluation, price opening of techno-commercially successful bidders and recommendation of award to successful bidder for all the CWP, SWP, FIM and non-EPC works. At no stage the detailed estimation has ever been done by MIAL.
- 7.2 For CWP works, the standardized flowchart for Contracts & procurement shows that estimation has to be done by the contractor (L&T), PMC has to review and approved only detail design and the quantity. Based on approved quantity L&T submit its cost proposal on Lump sum basis to MIAL and MIAL will only evaluate the cost proposal the previously agreed rates submitted by L&T.
- 7.3 Tendering has been done by L&T along with MIAL team for all the Sub-contract work Packages (SWP's). However, no estimation has done either by MIAL or L&T. Negotiations had been done with all the techno-commercially successful bidders are on random basis and didn't have MIAL's own supporting cost estimates to yard stick the quotes given by Sub-contractors.
- 7.4 The Site overhead estimated by MIAL for L&T is 2% for SWP/FIM and 4% for CWP. The modalities of site overhead are yet to be finalized with L&T. However, MIAL has planned to pay on agreed percentage or lump sum basis.
- 7.5 Under the unique administrative model evolved by MIAL to prepare DOP, the company has delegated all the powers to the Managing Director of MIAL before 19th Nov, 2011. However, new DOP has been formulated on 19th Nov, 2011(refer Annexure-VIII) based on the value of the works.
- 7.6 In the selection process of program manager, the technical bid and financial bid were evaluated simultaneously and also during the evaluation of financial bids, inviting a party to submit their quote is not as per standard procedure. The financial impact of the above work may be worked out by Financial Auditor.
- 7.7 There was no regular monitoring of cost by PMC, though it is clear in Annexure 1 (3.5 Cost control) of PMC agreement with MIAL which clarifies that PMC has to monitor actual cost and report of forecast coast. In that case, a separate Cost Consultant should have been appointed by MIAL to monitor the followings.
 - 7.7.1 Give early warning of any actual and potential variance in the overall and/or individual project castings
 - 7.7.2 Maintain overall and/or individual project cost control systems/budget control software systems
 - 7.7.3 In relation to Project contracts, prepare cost reports showing the original budget, revised outcome estimate and variance for each budget item
- 7.8 As stated in L&T agreement, the design service cost is ₹140 Crs which got increased by ₹56 Crs due to change in scope.
- 7.9 MIAL is planning to subcontract the entire works of IT system (12 systems) and procure different systems from different contractors and get it integrated by single agency. Then the whole package will be awarded to a single entity to operate in BOT basis.

- 7.10 Though there was delay in availability of front for execution in the shivaji statue area, the erection of head house roof has been done in an effective manner by utilizing highway truss without disturbing the statue preventing any delay of the progress of work in the other areas.

8.0 **RECOMMENDATIONS**

- 8.1 MIAL has to follow ISO standard procedures (tendering/procurement) for each stage related to selection of Vendors/ contractors/ agencies.
- 8.2 There is a need to develop a suitable mechanism at the national level for Projects of this nature so that accountability issues such as Cost Overrun are not placed at unreasonable risk in the interest of Project expediency.
- 8.3 The company should formulate and standardize the guidelines relating to estimation & Costing of the Project. Management shall review Project Cost quarterly and take the immediate course of action for any variation.
- 8.4 The company should evolve a system of finalizing the cost estimates before inviting the bids to maintain transparency and to ensure reasonableness of the offers received.
- 8.5 The company needs to further strengthen its system of processing of bids to bring the Project cost further down.
- 8.6 The Project cost including design should have been capped to avoid cost overrun, but unfortunately no steps have been taken to contain Project cost. The Auditors advise the implementing agencies to cap the Project cost in future for such type of Mega Projects.
- 8.7 The risk involvement and efforts required for CWP (Contractor's work portion) and SWP (sub-contract work package) are entirely different, however MIAL has kept same 17.14% fee structure for both types of contracts to be executed by L&T. The fee for SWP should have been kept around 10%. Fee for free issue material (FIM) should be kept around 5.0% instead of 7.56%.
- 8.8 Independent Cost Consultant should have been appointed right from beginning of the Project who would have been held responsible for cost overrun. They should have given triggers of cost overrun during different phases of the project implementation.

9.0 **ACKNOWLEDGEMENT**

- 9.1 Audit team acknowledges the advice given by AERA/AAI from time to time for compiling this study.
- 9.2 Audit team acknowledges the co-operation and assistance provided by MIAL management at all levels at various stages of the audit.

10.0 CONCLUSION

The development of the airport has been done by a consortium, which has members who have proven technologies in their respective fields of Project implementation and has accordingly contributed towards achieving this cherished goal. The cost incurred on the Project is somehow high but is in limit as provided in Benchmarking report. However there are few instances in the Project execution where Auditors found the cost is high.

The major cost increase is due to increase in enabling project cost, new additional projects & increase in prices of the material due to delay by 17 months in handing over the related area for Project execution.

The construction is being undertaken in the operational airport area, which resulted in constraint in land availability. Hence the material to be brought to the site had to be taken with utmost care so that there is nominal disturbance in operation of airport and discomfort of the passengers.

It may also be noted that due to cross runways, the Upgradation of the runway, taxiway, RETs & apron has been done in phased manner to have nominal disturbance in operation towards the airside.

The risk premium of all major contributors in the Project implementation is remarkably high which has been shared by MIAL in totality. It seems that the Main Contractor, sub-contractors/vendors have worked out their rates by considering a substantial risk premium.

The major variation during execution of any similar Project shall be got approved from MoCA/AAI before actually implementing it on ground. The cost estimates should be ready with the developer before floating NIT or calling quotations from competitive bidders.