Table of contents

List of Figures

List of Tables

EXECUTIVE SUMMARY

Jaipur International Airport is an operational civil airport owned by Airports Authority of India (AAI), 13 km South of Jaipur city, and has total land area 776 acres (~314 Ha.). It is presently a fully operational international airport and was granted the status of international airport on 29 December 2005. The Jaipur master plan 2025 takes into consideration the prescribed expansion during the preparation of the land use plan.

Airports Authority of India has planned expansion of the existing operations at Jaipur Airport by constructing the following:

- Expansion of Existing Terminal Building
- Construction of Airport Director's office
- Construction of multilevel car park
- Development of four-lane vehicular road from Terminal Building / Car parking
- Driver's canteen and toilet facility on the city side
- Sub-station, A/C plant room and related service facilities
- Construction of Boundary Wall with gates

The Existing Terminal building is serving both Domestic and International Passengers. The existing terminal building has handling annual capacity of 3.5 mppa and the proposed terminal building will have capacity of 10 mppa. The airport is developed for operation of Boeing 747-300 aircrafts in all weather conditions.

Table 8-1: Site location and accessibility

Description	Details		
Project Site	Sanganer, Jaipur district, Rajasthan		
Location	13kms from Jaipur via Tonk Road		
Coordinates	**Points**	**Latitude**	**Longitude**
	A	26°50'06.97"N	75°47'38.42"E
	B	26°50'09.62"N	75°47'42.49"E
	C	26°49'46.68"N	75°48'01.71"E
	D	26°49'46.20"N	75°48'46.17"E
	E	26°49'45.28"N	75°49'20.20"E
	F	26°49'44.60"N	75°50'22.99"E
	G	26°49'40.15"N	75°50'38.74"E
	H	26°49'35.72"N	75°50'39.21"E
	I	26°49'28.63"N	75°50'24.46"E
	J	26°49'24.59"N	75°49'34.00"E
	K	26°49'22.67"N	75°49'05.58"E
	L	26°49'17.45"N	75°48'13.05"E
	M	26°49'08.69"N	75°47'51.17"E
	N	26°49'27.55"N	75°47'42.10"E
	O	26°49'40.10"N	75°47'58.11"E
Total Area in hectares (Ha.)	Existing Area		Proposed Area
	314 Ha.		314 Ha.

Description	Details	
Total Area in acres	776 acres	776 acres
Access Road	Jaipur city arterial roads (Tonk Road, Airport Road, Sawai Pratapsingh Road) and National Highways (NH-52, NH-248)	
District Headquarter	Jaipur - 13 km, N	
Nearest Town	Jaipur - 13 km, N	
Nearest Railway Station	Getor Jagatpura - 3 km, ENE	
Nearest Airport	Agra Airport - 240 km, E	
Interlinked Project	This is independent project. Neither the proposed project nor other project/s are directly or indirectly linked and/or related to this project	

Source: (I) primary survey and site visit, Greencindia Consulting Private Limited, NCR, Ghaziabad; (II) AAI and (III) Google Maps 2018.

1 INTRODUCTION

1.1 BACKGROUND

Jaipur International Airport is an operational civil airport owned by Airports Authority of India (AAI), 13 km South of Jaipur city, and has total land area 776 acres (~314 Ha.). It is presently a fully operational international airport and was granted the status of international airport on 29 December 2005. The Jaipur master plan 2025 takes into consideration the prescribed expansion during the preparation of the land use plan.

Airports Authority of India has planned expansion of the existing operations at Jaipur Airport by constructing the following:

- Expansion of Existing Terminal Building
- Construction of Airport Director's office
- Construction of multilevel car park for at least 2,000 cars and surface parking for VIP cars &10 buses
- Development of four-lane vehicular road from Terminal Building / Car parking
- Driver's canteen and toilet facility on the city side
- Sub-station, A/C plant room and related service facilities
- Construction of Boundary Wall with gates

The Existing Terminal building is serving both Domestic and International Passengers. The existing terminal building has handling annual capacity of 3.5 mppa and the proposed terminal building will have capacity of 10 mppa. The airport is developed for operation of Boeing 747-300 and similar aircrafts in all weather conditions (Airport CODE-4D, existing).

Table 1-1: Jaipur City Population, Census 2011

Jaipur City	Population			Literates			Average Literacy (%)			Sex Ratio
	Total	Male	Female	Total	Male	Female	Total	Male	Female	
	3,046,163	1,603,125	1,443,038	2,215,535	1,246,245	969,290	83.33 %	76.65 %	89.38 %	900

Source: Census 2011

1.2 PROJECT PROPONENT

AAI under the Ministry of Civil Aviation is responsible for creating, upgrading, maintaining and managing civil aviation infrastructure in India. The main functions of AAI are as follows:

- Design, development, operation and maintenance of international and domestic airports and civil enclaves.
- Control and management of the Indian airspace extending beyond the territorial limits of the country, as accepted by ICAO.
- Construction, modification and management of passenger terminals.
- Development and management of cargo terminals at international and domestic airports.
- Provision of passenger facilities and information system at passenger terminals at airports.

- Expansion and strengthening of operation area, viz. runways, aprons, taxiway etc.
- Provision of Air Traffic Management Services (hereinafter referred to as "ATMS") over entire Indian air space and adjoining oceanic areas with ground installations at all airports and 25 other locations to ensure safety of aircraft operations.
- Provision of communication and navigation aids, viz. ILS, DVOR, DME, Radar etc.
- It has been planned by AAI to expand the existing Airport at Jaipur to cater the need of increased traffic load by extension of runway lengths & allied facilities for B-737-300 landing. Accordingly, the AAI utilized in-house expertise. AAI has almost all departmental processes at airports, such as airport feasibility studies, design of passenger terminals, cargo terminals, aircraft hangars, aircraft parking stand with fuel hydrant systems, runways, taxiways, all lighting systems, electric supply arrangements, baggage handling systems, car parking facilities etc. are undertaken in-house. Airport master planning including land use plans; environmental aspects etc. constitute an integral part of airport planning processes.

AAI has full-fledged sections for civil engineering, electrical engineering, which looks after planning and designing of new or expansion airport projects and maintenance of existing ones. AAI also takes up consultancies for designing and construction in India and abroad.

1.3 AIRPORT SECTOR PROFILE

India's transformation from an agrarian economy to an urbanized one is an inevitable consequence of GDP growth led by service sector and saturation of agricultural productivity. Air connectivity can ensure integration of such urbanizing areas with the rest of the country and national economy. Development of appropriate connectivity between robust urban agglomerations could check the influx of migrants to large metro and provide for more balance regional development.

The civil air transport network has been called the Real World Wide Web. It has been observed that the improvement in air connectivity has brought tremendous benefits to users of air transport services by:

- ✈ Reducing time spent in transit,
- ✈ Increasing the frequency of service,
- ✈ Allowing for shorter waiting times and better targeting of departure and arrival times;
- ✈ Improving the quality of service, such as reliability, punctuality and quality of the travel experience.

Air traffic in India has increased over last five years. The compound annual growth rate (CAGR) of total aircraft movement was 3.3% and of passengers 5.6% during year FY2011 to FY-2014. Globally, Indian civil aviation is ninth market. It stands fourth in domestic passenger volume.

Consequently, improvements in connectivity will effectively contribute to the economic performance of the wider economy through enhancing its overall level of productivity. Following table 1-3 shows the quantum of passengers handled at major airports in India in last few years.

Table 1-2: Passenger Handeled at Major in india (in millions)

S. No.	Airports	City	State	2012-13	2013-14	2014-15
1	Delhi International Airport Limited	Delhi	Delhi	34.4	36.9	41.0
2	Chhatrapati Shivaji International Airport	Mumbai	Maharashtra	30.2	32.2	36.6
3	Chennai International Airport	Chennai	Tamil Nadu	12.8	12.9	14.3
4	Kempegowda International Airport	Bangalore	Karnataka	12.0	12.8	15.4
5	Netaji Subhash Chandra Bose International Airport	Kolkata	West Bengal	10.1	10.1	10.9
6	GMR Hyderabad International Airport Limited	Hyderabad	Andhra Pradesh	8.4	8.8	10.5

Source: AAI, APAO

With the ever growing economy of Rajasthan, the state needs more infrastructure facilities to sustain the future demand of passengers and cargo and with the ever-increasing passenger traffic in the state.

The category-wise list of Airports in Rajasthan is listed below.

International Airport in Rajasthan

- Jaipur International Airport (Sanganer Airport)

Airports in Rajasthan

- Udaipur Domestic Airport (Maharana Pratap Airport)
- Jodhpur Airport (Civil Airport)
- Kota Domestic Airport
- Jaisalmer Domestic Airport
- Nal Domestic Airport (Bikaner Airport)
- Phalodi Air Force Station
- Suratgarh Air Force Station
- Ajmer /Kishangarh Domestic Airport (Under Construction)
- A new Greenfield airport at Neemrana is also proposed in Rajasthan.

1.4 AIR CONNECTIVITY PATTERN

In India, with its geographical spread interspersed with deserts, seas, forests and hilly terrain, regional and remote area air connectivity can play a crucial role in this context. Establishing or relying on railway / road networks for connecting such parts of the country may not be time effective or even viable (technically / financially) (Figure 1.1).

Also, while railway and road networks may be viable connectivity options to other parts of the country (not impacted by issues of terrain, security, etc.), air connectivity provides a key advantage in terms of time saving.

The routes connecting Tier-2 towns / cities to Tier-3 towns / cities1 only constitute about 7% of the air transport market in India in terms of seat deployment. While routes can be configured in numerous ways in terms of combination of frequencies, timing of the flights and aircraft sizes, a number of these routes are likely to witness traffic that can be better serviced using small aircraft such that the aircraft could be optimally utilized over the day as well as achieve viable PLF.

Figure 1-1 : Air Connectivity Pattern in India

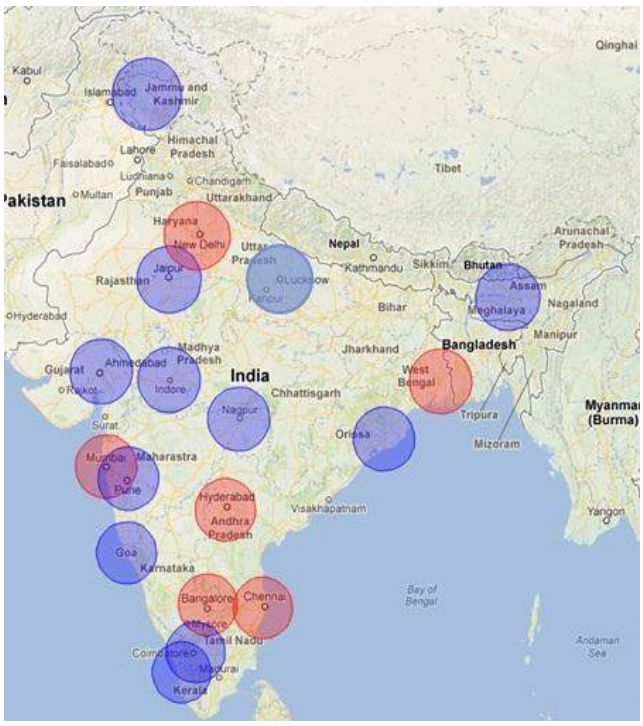


Figure 1-2 : Air Connectivity Pattern Across India

1.5 NEED OF THE PROJECT

Airports Authority of India has planned to expand Jaipur International airport, as the airport is reaching its full capacity. The increased air traffic comprises of both the domestic and international passengers, for economic purposes and tourism and heritage places such as Amer Fort, Hawa Mahal etc. in Jaipur and also other tourism destinations in Rajasthan.

The integrated terminal will cater to 5000 passengers in peak hour, since the growth trend indicate a total traffic of 10 million international and domestic passengers by 2025/2026.[1]

[1] Source: AAI Jaipur

1.6 EMPLOYMENT GENERATION

The direct employment during operation phase in proposed project will be 1,500 additional people. However indirect employment will be around 4000 people who will be employed in taxi operations and other allied services. During construction phase, 1000 labours and 100 supervisors will be employed in various construction, transportation and storage activities. It is also proposed that these labours will be employed locally for the proposed project.

1.7 STRUCTURE OF THE REPORT

The purpose of this report is to establish techno-economic feasibility for the proposed project at Jaipur International Airport. The report is divided into seven chapters excluding this chapter, the details of which are summarized below:

Chapter 1: Introduction- This chapter gives the basic information about the project and project area. It also discusses the justification of the project and the purpose of the EIA study.

Chapter 2: Project Description- This chapter discusses the layout drawing and design considerations for construction of new runway with all allied facilities like terminal building, Apron, Apron Shoulder, Taxi Track, Runway Shoulder, boundary wall, perimeter roads and parking facilities.

Chapter 3: Site Analysis- This chapter discusses the site profile, landform, and existing land use and drainage pattern. The land details, climate and metrological parameters are also described in various sections of the chapter.

Chapter 4: Planning Considerations- This Chapter presents the traffic forecasts for the airport and the methodology used for arriving at the same. The air traffic has various segments including traffic due to spillover from Jaipur International Airport.

Chapter 5: Proposed Infrastructure- This chapter discusses the Concept Plan for aviation support facilities and utilities also provides for the redevelopment & re-planning of existing air strip. The Jaipur Airport Concept Plan proposed for the construction of a domestic airport. The Concept Plan for the proposed airport defines the ultimate scope of the proposal and the development of facilities in accordance with the requirements of traffic. Earlier discussion on Traffic Analysis and Project Sizing are used as the basis for planning of the various components.

Chapter 6: Rehabilitation and Resettlement (R&R) Plan- - There is no R&R due to the proposed project as the land has planned as per the Jaipur Master Plan 2025.

Chapter 7: Project Schedule & Cost Estimates: This Chapter outlines the various clearances that are needed for the airport to get operational. Initial clearances such as 'in-principle' approval for setting up an airport at Jaipur have been arrived at MoU between.

Chapter 8: Final Recommendations: This chapter includes the recommendation for the development of Expansion of Jaipur International Airport, Jaipur District, Rajasthan based on the above studies.

2 . PROJECT DESCRIPTION

2.1 INTRODUCTION

Jaipur airport is owned by AAI. Jaipur airport has already been developed as one of the model airports by AAI to cater for operation of wide-bodied aircraft in all weather conditions. Regionally this is a major airport in Northern India. It serves as the primary civilian aviation hub for the metropolitan area of the cities of Jaipur and alternate airport to Delhi. The airport is served by many international and domestic carriers. This is possibly the second busiest airport in north India after Delhi (and one of the first ten airports from the 35 Non-metro airports to be upgraded as per policy of Govt. of India).

2.2 TYPE OF PROJECT

The proposed project is expansion of present Jaipur International Airport spread over an area of 776 acres (~314 Ha.). The proposed project falls in Category 7(a) of the Schedule vide EIA notification 2006 amended to date involving preparation of Environment Impact Assessment study and Environment Management Plan. However general condition is not applicable to this project.

This project is independent and does not link with other project/s which attracts directly or indirectly any provisions of schedule of EIA notification 2006 amended to date.

2.3 LOCATION & LINKAGES

The proposed airport is located at a distance of approximately 13km from Jaipur in Southern direction (from Jaipur city). It is connected via various city arterial roads (Tonk Road, Airport Road, Sawai Pratapsingh Road) and National Highways (NH-52, NH-248) to Jaipur. The nearest Railway station is Getor Jagatpura Railway Station, 3km to the ENE direction, and the nearest airport is Agra Airport, 240km to the east, and Delhi Airport 260km in the NE direction. The details of location of the proposed airport are given in Table 2.1. The location of site superimposed on satellite image and the coordinate map are provided in Figures 2.1 and 2.2 respectively.

Table 2-1: Site location & Accessibility

Description	Details		
Project Site	Sanganer, Jaipur district, Rajasthan		
Location	13kms from Jaipur via Tonk Road		
Coordinates	**Points**	**Latitude**	**Longitude**
	A	26°50'06.97"N	75°47'38.42"E
	B	26°50'09.62"N	75°47'42.49"E
	C	26°49'46.68"N	75°48'01.71"E
	D	26°49'46.20"N	75°48'46.17"E
	E	26°49'45.28"N	75°49'20.20"E
	F	26°49'44.60"N	75°50'22.99"E
	G	26°49'40.15"N	75°50'38.74"E
	H	26°49'35.72"N	75°50'39.21"E
	I	26°49'28.63"N	75°50'24.46"E
	J	26°49'24.59"N	75°49'34.00"E

Description	Details			
	K	26°49'22.67"N		75°49'05.58"E
	L	26°49'17.45"N		75°48'13.05"E
	M	26°49'08.69"N		75°47'51.17"E
	N	26°49'27.55"N		75°47'42.10"E
	O	26°49'40.10"N		75°47'58.11"E
Total Area in hectares (Ha.)	Existing Area		Proposed Area	
	314 Ha.		314 Ha.	
Total Area in acres	776 acres		776 acres	
Access Road	Jaipur city arterial roads (Tonk Road, Airport Road, Sawai Pratapsingh Road) and National Highways (NH-52, NH-248)			
District Headquarter	Jaipur - 13 km, N			
Nearest Town	Jaipur - 13 km, N			
Nearest Railway Station	Getor Jagatpura - 3 km, ENE			
Nearest Airport	Agra Airport - 240 km, E			
Interlinked Project	This is independent project. Neither the proposed project nor other project/s are directly or indirectly linked and/or related to this project			

Source: (i) Primary Survey and Site visit, Greencindia Consulting Private Limited, NCR, Ghaziabad; (ii) Site survey done by AAI and iii) Google Satellite Image 2018

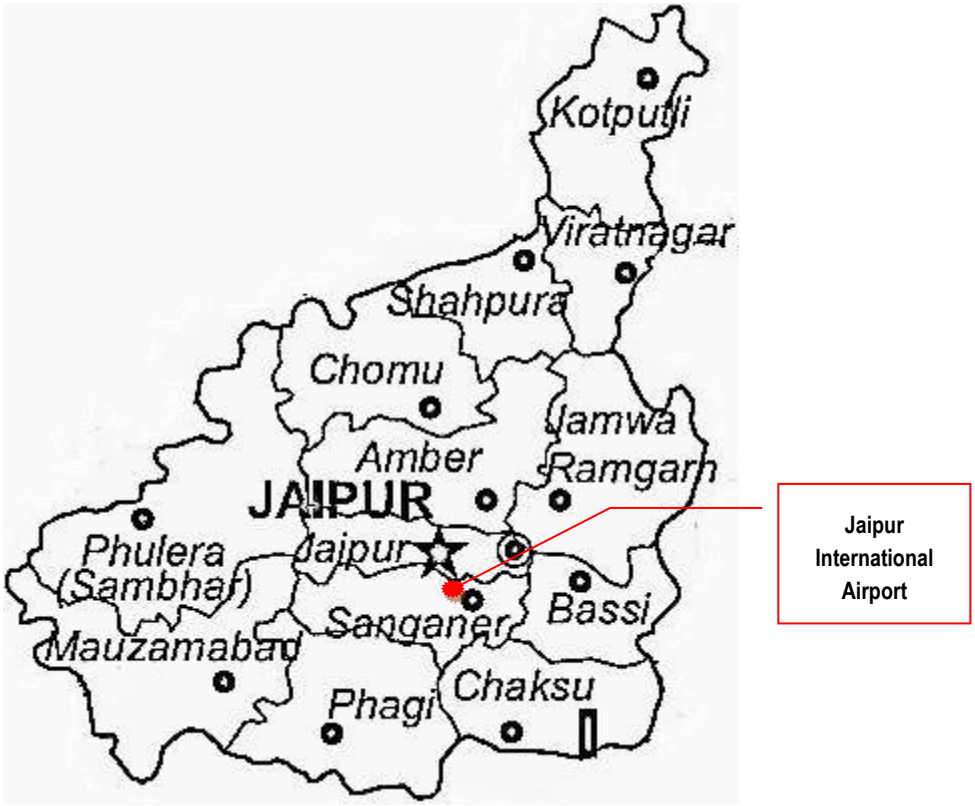


Figure 2-3: Location of Jaipur International Airport in the Administrative Map of Jaipur District

Source: http://www.indiamapssite.com/rajasthan/district/jaipur.html; downloaded on March 2018

2.4 SITE SELECTION & ALTERNATIVES

Jaipur International Airport is presently an operational civil airport, 13 kms from Jaipur city. There is a need to handle the exceeding air traffic, in the already saturated Airport. Therefore, AAI has proposed to upgrade and expand the airport, to enable commercial operation of Boeing 747-300 type of aircraft with more passenger carrying capacity per flight and handle more numbers of passengers. Therefore, no other alternative site has been considered. The proposal for modernization and expansion of the Jaipur airport is thus justified.

The need to identify alternate site was not required, since in order to utilize certain common infrastructural facilities of the existing airport, it was decided by AAI to modernize/expand the airport in Jaipur. It was also determined from the satellite imagery and further corroborated by preliminary site visit that there are no environmentally sensitive receptors within the proximity of the project site and technically also site is suitable for the expansion of the project.

2.5 PRESENT STATUS AND MAJOR FACILITIES AVAILABLE

Jaipur Airport has an area of 776 acres (~314 Ha.) and a single runway with orientation 09-27, and dimension of 3407 m x 45 m. The Existing Terminal building is serving both Domestic and International Passengers. The apron has a capacity of 21 bays presently, of which, 2 bays are 'in-contact' bays serving the Domestic Passenger Terminal Building.

2.6 PROJECT MAGNITUDE

AAI proposed to expand the present airport by constructing the following:

- Expansion of Existing Terminal Building
- Construction of Airport Director's office
- Construction of multilevel car park
- Development of four-lane vehicular road from Terminal Building / Car parking
- Driver's canteen and toilet facility on the city side
- Sub-station, A/C plant room and related service facilities
- Construction of Boundary Wall with gates

The peak hour capacity will increase from 720 passengers / hour to 5000 passengers / hour and the area of the airport will increase from 22,500 sqm to 1,25,000 sqm.

2.7 DESCRIPTION OF THE PROPOSED PROJECT

Expansion of Jaipur International airport shall be done as per details below. Airport will be developed for operation of Boeing 747-300 in all weather conditions and will involve the following activities. The site map is shown in **Figure 2.4**.

2.7.1 CIVIL WORKS

2.7.1.1 Expansion of Existing Terminal Building:

Construction of centrally air-conditioned Integrated Passenger Terminal Building of an area 1,25,000 Sq.m. (excluding 22,500 Sq.m area of existing Terminal building) and basement area of 20,000 Sq.m.. Considering the fast-growing air traffic and demand for better passenger facilities an area of 18,750 Sq.m. is to be kept for retail /commercial outlets / retiring rooms and airlines offices to tap future potential at the Airport. The building is to be provided with aesthetically appealing & soothing interior decoration matching the modern structure. Space planning to ensure that no dead Space/ Area is created in the building.

In the Terminal building, Departure area, Arrival area, Security hold area and Concourse area are to be provided with adequate nos. of toilets for gents, ladies and differently-abled persons and drinking water. Suitable number of ramps is to be provided for entry and exit of differently-abled persons in departure and arrival area. Provision of battery operated buggies for senior citizens / differently-abled persons as per requirement.

The design of Terminal building will include Media planning, Retail area planning, F & B plan, etc. Overall planning of Building will capture local architectural features and it will be part of design features of terminal. The design should include the required arrangement for its regular maintenance so as to make it in-built part of execution. Solar power generation viz solar lighting, solar roofing system, etc. will be provided. Maintenance friendly roofing & building façade system including provision of regular cleaning with maintenance hoists, hooks, etc. including cat walk / rope suspended platform / gondola etc. will be provided.

2.7.1.1.1 Departure Area

The integrated Terminal building with provision of Departure concourse, Check-in area with adequate number of Check-in counters, Immigration counters, Custom counters, Foreign Exchange counters, office space for Custom and Immigration, back- up offices for airlines, baggage conveyor belts, facilitation counter, weighing machines, counters etc.

2.7.1.1.2 Security Hold area

Security Hold area with Aerobridges and Bus Lounge with adequate seating arrangements and separate security check & holding area and associated facilities.

The passenger frisking area in Security Hold with adequate space for locating required number of DFMDs, frisking platforms, inspection table for manual checking of hand baggage and adequate space / rooms for security staff. X-ray machine for hand baggage, isolated Smoking area with proper ventilation in the security hold area.

Duty free / Retail Area Creation of Retail Islands/ Shops without affecting the passenger movement, Food& Beverage Area.

2.7.1.1.3 Arrival Area / Baggage Claim Area

The Integrated Terminal building with provision of adequate immigration counters and Custom counters, Foreign Exchange counter. Baggage Claim Area shall have adequate number of Baggage Conveyor Belts of

adequate size to be provided, space for storing baggage trolleys, mishandled baggage and counters / space for airlines and back up offices, and associated facilities.

Adequate space should be provided in the ground floor for required number of, back- up offices, and space for storing baggage trolleys, space for storage of mishandled baggage for airlines, office for Immigration, Custom and Quarantine.

Provision of Information counter & Pre-paid Taxi counter.

Canopies of appropriate size to be built to cover Baggage make-up and Break-Down area.

2.7.1.1.4 Common Concourse Area

Common concourse area in the ground floor to have provision for snack bar, travel requisite, Bank / ATM, post office, TR and Curio stall, drinking water, Meet-and-Greet area, first-aid room, facilitation counters, space for care taker office with store, Terminal Manager office with supporting office for AAI and airlines, Conference Room and other facilities at suitable location.

2.7.1.1.5 Miscellaneous Facilities

- Airport Director's office with associated office space, conference hall, retiring rooms, toilet for staff to be provided.
- Construction of multilevel car park with all amenities for at least 2,000 cars and surface parking for VIP cars &10 buses, Separate car / scooter park area for AAI and airlines staff at appropriate location. Multilevel car parking to be made for retailer in car parking area & it has to be developed on Built & Operate System and shall include its space planning and model for its operations.
- Development of four-lane vehicular road from Terminal Building / Car parking with canopy covering two lanes in front of the Terminal Building on the city side and connecting the main approach road to the city.
- Provision of VIP/CIP lounges, with adequate number of chairs, furniture, furnishings etc in the departure lounge common concourse, check-in area, and security hold area and arrival lounge.
- Provision of water supply system including pumping arrangement, Water Filtration, water cooler & R.O/U.V. Filters, Sewage Treatment Plant (STP) and Effluent Treatment Plant (ETP) as per norms and as per site conditions.
- Horticulture-landscaping, drainage system, water supply, rain harvesting etc.
- Driver's canteen and toilet facility on the city side.
- Sub-station, A/C plant room and related service facilities. Provision should be made for the AC Plant Room vertical shafts through AHU rooms, backup generators for essential services, etc. in the lower ground floor.
- Provision of acoustics for effective functioning of PA system.
- Providing city side compound wall depicting local architecture and with proper gates.

2.7.2 ELECTRICAL WORKS:

- Internal and external electrification for Terminal Building Complex, associated buildings, Car Park and roads.
- Augmentation of main power supply, Substation Equipment, DG Sets for Secondary Power supply and associated ancillary buildings.

- Provision of central air-conditioning & ventilation (HVAC) system & BMS for New Terminal Building.
- Provision of conveyor belts with In-line Baggage System and other equipment at departure area and inclined carousels at Arrival hall.
- Provision of fire detection & alarm system, provision for fire hydrants and water sprinklers system as per standards along with fire extinguishers.
- Escalators, Travellaters & Elevators with matching staircase.
- Provision of Passenger Boarding Bridges (PBB) for the specified parking stands.
- Provision of automatic sliding doors at exit and entry points of terminal.
- Provision of adequate number of Signage of world class standard, inside and outside the terminal building, car park area & City side approach road and air side area for guidance of passengers and visitors.
- Provision of Solar power for internal water requirement.

2.7.3 AIRPORTS SYSTEMS:

- Public address system and car calling system.
- Surveillance Close circuit TV system (SCCTV) and provision of adequate number of close circuit TV monitors, in the Security Control Room, Terminal Manager Room, APD Office etc.
- Provision of Flight Information Display System (FIDS) with adequate number of Display Devices in departure, arrival and security hold area for passenger facilitation.
- Provision of adequate number of X-ray machines for scanning Registered Baggage (RB)/ Hand Baggage (HB), including provision of required number of ETDs, DFMDs & HHMDs, as per BCAS norms.
- Provision of adequate no. of VHF FM Sets (Walkie-Talkie, Base Stations & Mobile Stations).
- Provision of Telephone Exchange / digital EPABX/ IP EPABX system for Terminal Building including telephone/ intercom instruments, wiring etc.
- Provision of CUTE, CUPPS and CUSS Systems.

2.7.4 ITSYSTEMS

- Passive and Active networking components such as OFC, UTP cabling, Routers, Core & Access switches and accessories. Provision of Raceways, cable trays, and conduit & cabling.
- Server room and adequate space for keeping network switches along with electrical power points & UPS.
- Access Control System as per BCAS requirement.
- Provision of Internet, VPN bandwidth, Wi-Fi system.

All the works are to be carried out as per DGCA, BIS / ICAO documents. Green building norms to be followed for fourstar ratings of GRIHA.

2.8 CONSTRUCTION MATERIAL

The construction material used in proposed project will be sourced from local approved vendors through the contractor and the specification will be as per the conditions laid in contract. The contractors work will monitor

approved and certified by the Engineering-In Charge. The details of construction materials are given in Table no. 2.2.

Table 2-2: Construction Material Details

Sl. No	Description	Unit
1	GSB	11,94,4755 Cum
2	Stone Agg.	16,29,936 Cum
3	Bituminous	21,378 Kg
4	Structural Steel	23,51,250 Kg
5	TMT bar	11,57,863 Kg
6	Sand	15,812.94 Cum
7	Cement	1,04,806 Bags

Source: AAI, Greencindia

2.9 RESOURCE OPTIMIZATION

The resource optimization is always prerequisite for any development project and saving the precious. This requires a new approach to viewing, evaluating, understanding, and communicating, which ultimately requires new approaches to science, engineering, and economics. In quest towards resource optimization in proposed project the tradition practices are substituted by modern practices involving water reduction, rain water harvesting, energy conservation etc.

2.9.1 Water Saving Practices and Reduction

In India, the average domestic water consumption is 4.1% of the total water use. As per the Bureau of Indian Standards, the per capita water requirement varies with building type. As per BIS, for residential buildings with a population of 20,000 - 1,00,000, the per capita consumption is 100-150 lpcd and for those with population above 1,00,000, the consumption is 150-200 lpcd. Out of the 150 to 200 litres per head per day, 45 litres per head per day may be taken for flushing requirements and the remaining quantity for other domestic purposes. For the other types of buildings, the water requirement varies between 30 to 340 LPCD. Water usage for applications such as flushing, bathing and washing is as high as 93% of water demand in any building. However, measures can be adopted to reduce this demand through use of water efficient practices and devices (efficient plumbing fixtures). These would result in significant saving of water and contribute towards protection of the environment. Some of the common practices and devices that can save water are covered below:

- **Monitoring water use:** Use of water meter conforming to ISO standards should be installed at the inlet point of water uptake and at the discharge point to monitor the daily water consumption. This would also enable the user to identify if there are any points of leakages.
- **Use of water saving devices/ fixtures:** About 40% of all water used indoors is in the bathroom and toilets and more than 10% of that used is in the kitchen. The conventional fixtures used in toilets use water at the rate of 12-15 litres per flush. In normal scenario, the taps and showerheads in buildings consume water at the rate of 20 litres of water per minute. The flow rates of these fixtures depend on the pressure at which these are operated. However, there exists the opportunity to lower the consumption through the use of following efficient fixtures:

- **Low flow flushing systems:** Water consumption is more for flushing applications in any building. Use of more efficient water saving toilets having dual flush system can result in a saving of at least 50% of water. Dual flush systems can be installed in order to allow different volume of water for flushing liquids and solids. To facilitate efficient cleaning at low volume, it is possible to install suitable water closets.

  Sensor based fixtures: Sensors based fixtures functions only in the presence of user. Various types of sensor based technologies are magic eye sensor for urinals, solenoid self-operating valves etc. Infrared and ultrasonic sensors discharge a set amount of water only when the taps are being used thus resulting in water saving as compared to manually operated valves. In addition to its advantage in reducing water consumption, sensor operated taps also result in better hygiene particularly in a public place.

- **Urinals:** By using automated flushing urinals usage of water is very high. By replacing these with sensor-based urinals such as magic eye sensor, the water use is reduced to 0.4 litres per flush. In place of conventional urinals, if the low flow urinals are used, water saving amounts to 3 litres per flush.
- **Waterless Urinals:** Waterless urinals are an efficient technique to save water. The system works without any water but with the use of biodegradable liquid in the cartridge fitted at the bottom of the urinal. Each cartridge is adequate for 7000 uses.
- **Water Taps:** A normal tap works at a flow rate as high as 20 lpm. Use of low flow faucets along with other water saving devices such as auto control valves, pressure reducing devices, aerators and pressure inhibitors for constant flow, magic eye solenoid valve, self-operating valves can result in 25 – 50% of water savings.
- **Tap aerators:** Tap aerators can be effective by facilitating cleaning through increasing the pressure at which the water is delivered even at low flow rates. Installation of flow regulators can be done where the aerators cannot be installed.
- **Auto control valves:** Automatic shut-off valves can be used to control the flow of water for a preset time limit and with use, which is linked to the release of the lever or handle.
- **Pressure reducing device:** The reducers can be used to control the pressure in the water line, which will affect the discharge rate and also to maintain uniform flow at different levels. A pressure reduction device can be installed when the pressure in the line exceeds 50-60 psi. It is observed that a reduction of pressure from 80 to 65 and 50 psi can result in a reduction of water flow of 10% and 25%, respectively.
- **Dual Plumbing System:** Introduction of dual pipe in the buildings for use of water with different water quality namely ground water with high hardness, municipal supply water, treated soft water and recycled water can result in optimal use of water for different applications thus saving on the high quality water. Installation of dual pipe plumbing for using recycled water / rain water can save the potable water from municipal supply or ground water. There can be two lines, one supplying fresh water for drinking, cooking and bathing etc. and other for supply of recycled water for flushing, landscape irrigation, car washing, thermal conditioning etc. This results in saving of more than one-third of fresh water demand and life of existing sewerage

can be improved and also promotes decentralized treatment system. This system needs space for establishment and initial investment and retrofitting.

- **Water Quality:** In addition to providing adequate water supply for building occupants, quality of water is also a key concern. Bureau of Indian Standards has recommended a set of parameters, which should be complied with as per IS 10500:2012. Further as per CPCB, water quality for different classes of inland waters has been given for different applications, which should be followed.

Table 2-3: Standards for Drinking Water as per BSI

Sl No.	Parameters	Units	Drinking Water IS:10500-2012	
			Acceptable Limit	Permissible Limit
1	Colour	Hazen	5	15
2	pH value	-	6.5-8.5	No Relaxation
3	Turbidity	NTU	1	5
4	Total Dissolved Solids	Mg/l	500	2000
5	Anionic Detergents as MBAS	Mg/l	0.2	1
6	Boron (as B)	Mg/l	0.5	1
7	Calcium (as Ca)	Mg/l	75	200
8	Chloride (as Cl)	Mg/l	250	1500
9	Copper (as Cu)	Mg/l	0.05	1.5
10	Fluride (as F)	Mg/l	1	1.5
11	Iron (as Fe)	Mg/l	0.3	No relaxation
12	Nitrate (as No3)	Mg/l	45	No relaxation
13	Phenolic Compounds	Mg/l	0.001	0.002
14	Sulfate (as SO4)	Mg/l	200	400
15	Total Alkalinity (as CaCO3)	Mg/l	200	600
16	Total Hardness (as CaCO3)	Mg/l	200	600
17	Zinc (as Zn)	Mg/l	5	15
18	Cyanide 9as CN0	Mg/l	0.05	No Relaxation
19	Lead (as Pb)	Mg/l	0.01	No Relaxation
20	Total Arsenic (as As)	Mg/l	0.01	0.05
21	Total Chromium (as Cr)	Mg/l	0.05	No Relaxation

Source: IS: 10500:1991, Bureau of India Standards, New Delhi

Table 2-4: Standards for Drinking Water as per CPCB

Characteristics	Unit	Designated use class of inland waters				
		A	B	C	D	E
Dissolved Oxygen, minimum	Mg/l	6	5	4	4	-
pH	-	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.0-8.5
BOD (5days at 200c)	Mg/l	2	3	3	-	-
Total Coliform organisms, max	MPN/ 100 ml	50	500	5000	-	-
Colour	Hazen	10	300	300	-	-
Chlorides (as CL), max	Mg/l	250	-	600	-	600
Sodium Absorption ratio, max	-	-	-	-	-	600

Characteristics	Unit	Designated use class of inland waters				
		A	B	C	D	E
Boron (as B)	Mg/l	-	-	-	-	2
Sulphate (as SO_4)	Mg/l	400	-	400	-	1000
Nitrates (as No3), max	Mg/l	20	-	50	-	-
Free ammonia (as NH3)	Mg/l	-	-	-	1.2	-
Conductivity at 250c, max	Microhm/cm	-	-	-	1000	2250
Arsenic (as As), max	Mg/l	0.05	0.2	0.2	-	-
Iron (as Fe)	Mg/l	0.3	-	50	-	-
Fluorides (as F)	Mg/l	1.5	1.5	1.5	-	-
Lead (as Pb), max	Mg/l	0.1	-	0.1	-	-
Copper (as Cu)	Mg/l	1.5	-	1.5	-	-
Zinc (as Zn), max	Mg/l	1.5	-	1.5	-	-
Manganese (as Mn)	Mg/l	0.5	-	-	-	-
Total Dissolved Solids	Mg/l	500	-	1500	-	2100
Total hardness (as CaCO3)	Mg/l	300	-	-	-	-
Magnesium (as Mg)	Mg/l	100	-	-	-	-
Chlorides (as Cl)	Mg/l	250	600	-	-	600
Cyanides (as CN)	Mg/l	0.5	0.5	0.5	-	-

Source: IS: 10500:1991, Bureau of India Standards, New Delhi
Notes: A= Drinking Water Source without conventional treatment but after disinfection; B= Outdoor bathing (Organized); C= Drinking water source after conventional treatment and disinfection; D= Propagation of Wild life and Fisheries; E= Irrigation, Industrial Cooling, Controlled Waste disposal
Source: Central Pollution Control Board, Government of India, New Delhi

2.9.2 Water Use Reduction:

To estimate the reduction in water use achieved by the building by following the mitigation measures, use following steps: (i) Step 1: Estimate total water demand based on the occupancy and type of building; (ii) Step 2: List various efficient fixtures and other measures and (iii) Step 3: Calculate demand reduction as compared to the BIS per capita water consumption.

2.9.2.1 Domestic Use for 24 Hrs.

Under normal conditions, water consumption per person for flushing is 45 litres (9 litre/flush with 5 number of uses). With efficient fixture (3 and 6 litre/flush), water use is 21 litre (3 litre/flush with 3 uses and 6 litre /flush with 2 uses). Water use per person for washing with normal fixture with a flow rate of 20 litres per minute is 40 litre (assuming use for 2 minutes), while with efficient fixture (flow rate of 7.5 lpm) is 15 litres.

Table 2-5: Estimation of Domestic Use Water Reduction

S. No.	Category	Normative Water consumption in lpcd	Normative in Water consumption in lpcd	Reduction in %
1	Drinking Water	7	7	-
2	Bathing	20	20	-
3	Flushing	45	21	53
4	Washing	40	15	62
5	Miscellaneous	23	23	-
Total per capita requirement		**135**	**86**	**36**

Source: Manual on Construction Projects, CPCB, Government of India, New Delhi

2.9.3 Water Use during Construction

Water used shall be clean and reasonably free from injurious quantities of deleterious materials such as oils, acids, alkalis, salts and microbial growth. Generally, potable water shall be used. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, that water should not be used. As a guide, the following concentrations may be taken to represent the maximum permissible limits of deleterious materials in water.

Limits of acidity: To neutralize 200 ml sample of water, it should not require more than 2 ml of 0.1 N caustic soda solutions.

Limits of Alkalinities: To neutralize 200 ml sample of water it should not acquire more than 0.1 ml of 0.1 N hydrochloric acid.

Percentage of solids should not exceed:

Organic	200 ppm (0.02%)
Inorganic	3000 ppm (0.30%)
Sulphates	500 ppm (0.05%)
Alkali chlorides	1000 ppm (0.1%)

2.9.4 Water Conservation in Landscaping

Landscape forms an important part of the building environment. This is constituted by combination of vegetation, paving and various other landscape features such as water bodies. The vegetation includes lawns, shrubs, herbs and trees. In general, the water demand for lawns and shrubs are higher as compared to trees, which does not require or require less water after establishment. In addition, native species also require less water.

2.9.4.1 Estimation of Water Demand for Landscape

The water requirement of the landscape can be estimated using the following equation:

$$\text{Water Requirement (lpd)} = \frac{(\text{Canopy area } (m^2) \times \text{Evapo-transpiration rate (mpd)} \times \text{plant factor} \times 1000)}{\text{Irrigation Efficiency}}$$

- **Monthly Evapotranspiration rate (ET0):** The potential evapo-transpiration rate (PET) is the climate factor, refers to the amount of water required by the plant for healthy growth (depending on the climate). Evapo-transpiration rate determines the rate at which plants lose water through evaporation. It is affected by humidity and temperature at a given time. These rates vary with the season and are different for different months.
- **Canopy area** is the area covered by shrubs, grass covers, and for trees it is the plan view and is assumed as 25 m^2 per tree.
- **The plant factors are categorized as**- (i) 1 for evergreen fruit trees, small shrubs, lush ground covers; (ii) 0.7 for Newly planted native plants in semiarid and arid regions; ornamental or shade trees and shrubs native to more humid areas (iii) 0.4 for plants native to the areas.

2.9.4.2 Measures for Reducing Water Demand for Landscape:

The water consumption for the gardening depends on the type of plant species and the plant factors. As the plant factor for native species and trees is the minimum, one of the options to reduce the water demand for gardening is to include more native species and low water consuming species. Other options include use of efficient fixtures for watering, following certain best practices to minimize losses and optimise consumption.

Efficient irrigation equipments:

- **Drip irrigation:** To save water, drip irrigation is an efficient technique as it prevents loss of water due to evaporation, run–off and percolation. Further, it has a better control and facilitates uniform water distribution. However, this system cannot be used for lawns and ground covers but for non –native turf and other non-xerophytic plants.
- **Sprinkler irrigation:** Sprinkler irrigation system requires a network of pipes and pumping system to maintain sufficient pressure for uniform distribution. It is best suited for areas with sandy soils which have high infiltration rates. To prevent water logging, the system should be designed in such a way that infiltration rate exceeds the application rate. Sprinklers which can produce fine sprays are more efficient as compared to those that produce large water droplets. The efficiencies of irrigation systems differ widely. Further, to improve the efficiency certain measures can be followed, which includes use of a pressure regulator for pressures greater than 30 psi which will significantly reduce the loss during watering.
- **Efficient central systems:** An auto irrigation system with programmed time schedule can be installed for optimal use of water. To avoid over watering particularly during the rainy season, a rain shut-off device and soil moisture sensor should be used. It is also advisable to group the plants based on their water needs to minimize water loss.
- **Fixed time schedule for watering:** Time schedule for watering of plants plays an important role in saving water. Irrigation should be done during the coolest time of the day (early mornings and evenings) to avoid loss due to evaporation and wind drift. Also, the frequency of irrigation should be reduced during the winters. Regular flushing of the irrigation lines and other parts should be done. The use of combination of mitigation options can result in savings of water as indicated in Table 2.3. The table indicates the reduction in water that is possible by stepwise reduction in areas of high water consuming species. By reducing the lawn area by 50% and replacing it with shrubs, it is possible to achieve 32 % savings and by further introducing native species to the level of 25%, further increase in savings of 42% is achieved.

Table 2-6: Estimates Saving in Water

S. No.	%	100% Lawn	50% Lawn: 50% Shrubs	50% Lawn: 25% Shrubs: 25% Native	100% native
1	Saving in %	-	32	42	64

Source: Manual on Construction Projects, CPCB, Government of India, New Delhi

2.10 WATER REQUIREMENT & SUPPLY

2.10.1 WATER SOURCE & DEMAND

The project will utilize the water supply from nearby municipality. The daily consumption of water during operation phase will be about 1512.5 KLD of which ~810 KLD will be fresh water and ~702 KLD will be recycled water.

Table 2-7: Water Estimation

S. No.	Parameters	Unit	Quantity	Water Consumption (LPCD*)		Water Requirement in KLD			Net flow to Sewer in KLD (80% of fresh and 100% of recycled)
				Fresh	Recycled	Fresh	Recycled	Total	
A	**OPERATION PHASE**								
i	Passengers	No./ day (10 m/yr)	27,397	7.0	8.0	191.8	219.2	411.0	372.6
ii	Visitors including drivers	No.	13,699	7.0	8.0	95.9	109.6	205.5	186.3
iii	Airport Staff (including airline ground personnel)	No.	4,500	15.0	30.0	67.5	135.0	202.5	189.0
iv	Residential Area	No.	630	21.0	65.0	13.2	41.0	54.2	51.5
v	Kitchen, floor Washing & Restaurant Seats	No.	1,500.0	21.0	65.0	31.5	97.5	129.0	122.7
Total Terminal Water Demand						**399.9**	**602.2**	**1,002.1**	**922.1**
vi	Landscape	Area (sqm)	2,00,000		0.5 l/m2/day		100.0	100.0	
vii	DG Set Cooling (3X5000 kVA+2X2000 kVA)	l/kVA/hr	0.9	410.4	0.0	410.4	0.0	410.4	
Grand Total Water Demand						**810.3**	**702.2**	**1,512.5**	**925.7**
viii	Fire Fighting	*2,00,000 litres of water*							
ix	**Waste water from Aircrafts @ 200L/aircraft for 18 aircrafts/day**								**3.60**
x	**Total Waste Water Generated**								**925.74**

S. No.	Parameters	Unit	Quantity	Water Consumption (LPCD*)		Water Requirement in KLD			Net flow to Sewer in KLD (80% of fresh and 100% of recycled)
				Fresh	Recycled	Fresh	Recycled	Total	
B	**CONSTRUCTION PHASE**								
i	Daily Labour	No.	500.0	15.0	30.0	7.5	15.0	22.5	
ii	Residential Labour	No.	500.0	21.0	65.0	10.5	32.5	43.0	
iii	Officials	No.	100.0	15.0	30.0	1.5	3.0	4.5	
iv	Civil Works	L/m2	30,000.0	1.0		30.0		30.0	
Total Water Demand in KLD						**49.5**	**50.5**	**100.0**	**80.00**

Source: Estimates as per Greencindia

2.10.2 WATER STORAGE

Since the hours of supply may not be continuous, it is recommended to go for 3 days bulk storage at the main receiving tanks, wherein the domestic water will receive the desired level of treatment. Further to bulk storage, individual Buildings / Utility will have their own storage tanks catering to a day's requirement.

2.10.3 WATER DISTRIBUTION

Treated water will be pumped into the main header pipe to distribute water to the storage tanks located in the individual building / utilities i.e Terminal Building, Maintenance Building, ATC Tower, Commercial Building, Shopping Area and Admin Office Building.

The pump system at the receiving tank will be hydro-pneumatic type with pressurized diaphragm tank for starting & stopping pumps.

Storage tanks in individual buildings will have solenoid controls to regulate & control the inflow. From these storage tanks water will be pumped into the internal plumbing system of respective buildings through variable speed hydro-pneumatic pumps.

The Terminal buildings, especially, will witness periodic peak flow surge along with relatively very low demand periods. It is recommended for optimization of energy to go for multiple pump configurations to offset such variance in demand. It is proposed to integrate the water system with Building Management controls.

2.11 WASTEWATER GENERATION AND TREATMENT

The main source of drainage generation will be the discharges from toilets (water closet), urinals, sinks, pantry's, kitchen and other similar utilities. The total wastewater generation in operation phase will be 926 KLD and that during construction phase is 80 KLD. The wastewater will be treated in 1,110 KLD MBBR technology STP.

The MBBR technology has following advantages

- It provides primary, secondary and tertiary treatment all in one unit; in a single evergreen facility open to atmosphere;
- No pre-treatment and no chemical usage;
- Odour-free;
- Low energy requirement.

The sewage shall be collected by gravity into the collection tank/equalization tank of Sewage Treatment Plant (STP) via perforated screens to prevent the large particles into system. In equalization tank, pH and temperature of incoming sewage will be equalized. The sewage from equalization tank will be pumped to Moving Bed Biofilm Reactor (MBBR) reactor for biological treatment, where required quantity of air will be supplied to meet the oxygen requirements by means of blower and fine bubbles air diffusers. In MBBR reactor, thousands of polyethylene biofilm carriers operates in mixed motion within an aerated wastewater treatment basin. Each individual biocarrier increases productivity through providing protected surface area to support the growth of heterotrophic and autotrophic bacteria within its cells. It is this high-density population of bacteria that achieves high-rate biodegradation within the system, while also offering process reliability and ease of operation. After MBBR reactor, sewage will flow by gravity to settler (tube type or equivalent) where sludge will be settled at the bottom due to gravity. There will be provision for sludge recirculation, if needed. This settled sludge may be recycled through sludge pump to MBBR reactor to meet the mixed liquor suspended solids (MLSS) requirement. Excess sludge will be discharged through a filter press where solid and liquid will be separated. The sludge collected with have low moisture and after drying can be used as manure. The collected liquid will be recirculated through the system. Final discharge of treated waste water from settler will be collected in chlorine contact tank, where some chlorine will be dosed for disinfections of treated waste water. Then, treated sewage will be pumped for tertiary treatment through duel media filter or it will be passed through Ultraviolet (UV) disinfection system. Treated sewage will meet the norms prescribed by Environmental (Protection) Rules,1986, Schedule VI for Discharge to Inland Surface Water but will be utilized for flushing, HVAC and for irrigation of greenery & landscaping purpose. Only in monsoon, some treated sewage, which was for irrigation, may be discharged to surface water

The plant will be designed to meet the standards stipulated by the Pollution Control Board. As mentioned earlier the treated waste is envisaged to be used for landscaping and for Air-conditioning makeup. To achieve this, the plant will meet the standards especially for pH, BOD and suspended solids (SS) parameters as depicted in **Table 2.8.**

Table 2-8: MBBR Output Water Quality

Sl No	Parameters	Inlet	Outlet	General Standards for Discharge of Environmental Pollutants Part-A : Effluents: Inland Surface Water
1	BOD	300 mg/l	Less than 20 mg/l	30 mg/l
2.	COD	400 mg/l	Less than 150 mg/l	250 mg/l
3	Oil & Grease	50 mg/l	Less than 10 mg/l	10 mg/l
4	TSS	200 mg/l	Less than 50 mg/l	100 mg/l
5	pH	6.5-8.5	6.5-8.5	5.5 to 9

Source: CPCB

No treated waste water will be discharged outside the airport.

2.12 STORM WATER DRAINAGE

Storm drainage will be designed using the rational formula

Q = Cia

Where C = Coefficient of Run off

i = Intensity of rainfall in m/sec

a = Contributing area in m2

Runoff coefficients to be assumed are as below:

- Paved area = 0.9
- Building Roofs = 0.85
- Soil / Grass = 0.30
- Gravelled Area = 0.50

Since the airport is located in a rain belt having annual rainfall exceeding 500mm, it is recommended to design the storm drainage system for 100 mm / hr intensity of rainfall.

2.13 POWER REQUIREMENT & SUPPLY

Total load estimation for Jaipur Airport works out to 10 KVA (approx). The bulk power supply will be drawn from the grid of JVNL. The electrical supply system includes HT panel, DG set (5000 KVA - 3(W)+ 1(SB), 2000 KVA - 2 (W)+ 1(SB), Transformer and other LT panels. The essential electrical services shall be backed with DG sets along with PLC panel. All the electrical HT & LT cables shall be laid as per the stipulations of CPWD specifications.

2.14 SOLID WASTE MANAGEMENT

Construction Phase: During construction phase, solid waste will be refilled for levelling etc. No solid waste will be disposed outside. Organic waste will be treated at site.

Operation Phase: Twin bin waste collection system– Green bins for bio-degradable wastes and blue bins for non-biodegradable wastes shall be provided. Waste collection shall be done on a door to door basis, and temporarily stored at identified locations before disposing as per established laws and procedures at Jaipur Municipality waste disposal site.

Hazardous waste shall be treated in accordance with Hazardous Waste Management Rules 2008, Batteries waste shall be handled in accordance with Batteries Management Rules, 2010 and E waste as per E-waste Guidelines, 2008.

Bio Medical Waste shall be collected and disposed in accordance with Bio Medical Waste (Management and Handling) Rules, 1998

2.15 FIRE SAFETY

2.15.1 Fire Suppression

This section only deals with the fire protection services related to Hydrants, Sprinklers and Extinguisher. Fire protection in the context of this project is required for the following:

- Protection of occupied buildings like Terminal Building, ATC Tower, AFI, Commercial Development.
- Protection of ancillary buildings like Maintenance buildings, Workshop & utilities etc.
- Protection of amenity centres like Shopping & Kiosks
- Protection of Fuel Farm.
- Protection of Apron & Runways
- Electric substation, Plant rooms
- Aircraft related fires

2.15.2 Fire Reserves

The type of fire within an aircraft complex may range from those caused in the human occupied structures like Terminal Building, ATC Tower, Offices, Shopping & Commercial, where human safety is of prime consideration to the workshop and hanger where equipment protection is primary objective. Besides this is the additional task of aircraft fire rescue. Considering the diverse requirement of air and land side fire service multiple underground fire reserve with pumping stations are proposed.

2.15.3 Pumping Arrangement

Pump house and UG sump shall also be developed alongside of the substation for water supplies for the airport.

2.16 AIR CONDITIONING SYSTEM

The cooling requirements for the proposed project have been estimated on the basis of the following design assumptions.

2.16.1 Outside Ambient Conditions

Summer: DB: 40^{o} C (105^{o} F) & WB: 28.33^{o} C (83^{o} F).

Monsoon: DB: 32.2^{o} C (90^{o} F) & WB: 30^{o} C (86^{o} F).

Equipment performs to the above ambient conditions and not fail in conditions of 43^{o} C DB (dry bulb).

2.16.2 Inside Design Condition:

Room Temperature: 23^{o} C + 1.1^{o} C

Relative Humidity: 55% + 5%

2.16.3 DESIGN PARAMETERS

2.16.3.1 DUCTING WORK:

Method of Duct Design Equal friction method:

- Maximum air velocity in supply duct FPM : 1200.0
- Maximum air velocity in return duct FPM : 800.0
- Friction loss in duct (maximum) MM Wg in 100 Mt run : 6.66
- Maximum Velocity at supply air grill outlet FPM : 150.0

The duct shall be fabricated out of galvanized sheet, class VIII (Zinc coating 120 gm/m² f nas per the parameters given below which are conforming to IS 655-1963.

Table 2-9: Ducting Tape

Maximum	Thickness	Type of Transverse	Bracing
Upto 600	0.63	S-drive, pocket or bar, slips, on 2.5 m ceners	None
601 to 750	0.63	S-drive, pocket or bar, slips, on 2.5 m Centers, S-drive 25 mm pocket, or 25 mm bar slips on 2.5 m centers.	25 x 25 x 3 mm, angles, 1.2 m from joint.
751 to 1000	0.80	Drive, 25 mm pocket or 25 mm bar slips, on 2.5 m centers 40 x 40 mm angles connections.	25 x 25 x 3 mm angles, 1.2 m from joint.
1001 to 1500	0.80	40 mm bar slips, with 35 x 3 mm bar reinforcing on 2.5 m centers	40 x 40 x 3 mm angles, 1.2 m from joints.
1501 to 2250		40 x 40 mm angle connections, or 40 mm bar slips, 1 m maximum centers with 35 x 3 mm bar reinforcing.	40 x 40 3 mm diagonal angles, or 40 x 40 x 3 mm angle 60 cm from joint.

Source: AAI

2.16.3.2 INSULATION:

Maximum temperature rises in the supply air duct from Air-handler's outlet to farthest outlet in ºC 1.10

2.16.3.3 NOISE AND VIBRATION CONTROLS

The air conditioning contractor must take all necessary precautions to have minimum noise generation and its transmission. Minimum vibration as permitted by IS relevant code shall be ensured. A few points for guidance only are given below:

Double fire retardant flexible connections shall be provided from air discharge to outlet of air-handler to the duct.

Vibration isolation pads of suitable thickness commensurate to loading for isolation of vibration shall be provided under all equipment. In consultation with manufacturer for proper selection of vibration isolators

Flexible conduit connections of minimum diameter of 50mm to motors shall be provided. All loops should be large enough to allow connections to remain flexible.

All conduit connection where conduits are 60mm or larger shall be made of 1.2-meter minimum length conduit installed in the shape of U and grossly slack to provide maximum vibration isolation.

The floor supported piping shall be mounted on pipe supports with 7.5mm ribbed neoprene pads between the base plate of the pipes and the floors.

All items suspended from false ceiling shall be isolated on separate hangers.

In case of ducts, conduits, pipes & tubes the annular space between construction and penetrating element shall be sealed with sand cement plaster.

The supply duct starting from air handling unit & plenum shall be provided with 12 mm thick acoustic lining as indicated in the tender drawings.

The air-conditioning contractor shall take all other precautions or shall make his own arrangements even if not specified in the tender documents for eliminating high noise levels & shall minimize vibrations in all mechanical equipment without any additional cost.

3 . SITE ANALYSIS

3.1 INTRODUCTION

Site analysis is a pre-design research activity which focuses on existing and potential conditions on and around the building site. It is an inventory of the site factors and forces, and how they coexist and interact. The purpose of the analysis is to provide thorough information about the site assets and liabilities prior to starting the design process. The typical site analysis includes the site location and size, neighborhood context, zoning, legal aspects, geology, physiography (natural and man-made features), hydrology, soils, vegetation, wildlife, climate, culture, pedestrian and vehicular circulation, access, utilities, historic factors, density, sensory stimuli, and any other factor deemed appropriate for the particular site. This chapter discusses the site profile, landform, existing land use and drainage pattern. The land details, climate and metrological parameters are also described in various sections of this chapter.

3.2 LOCATION & CONNECTIVITY

The proposed airport is located at a distance of approximately 13km from Jaipur in Southern direction (from Jaipur city). It is connected via various city arterial roads (Tonk Road, Airport Road, Sawai Pratapsingh Road) and National Highways (NH-52, NH-248) to Jaipur. The nearest Railway station is Getor Jagatpura Railway Station, 3km to the ENE direction, and the nearest airport is Agra Airport, 240km to the east, and Delhi Airport 260km in the NE direction.

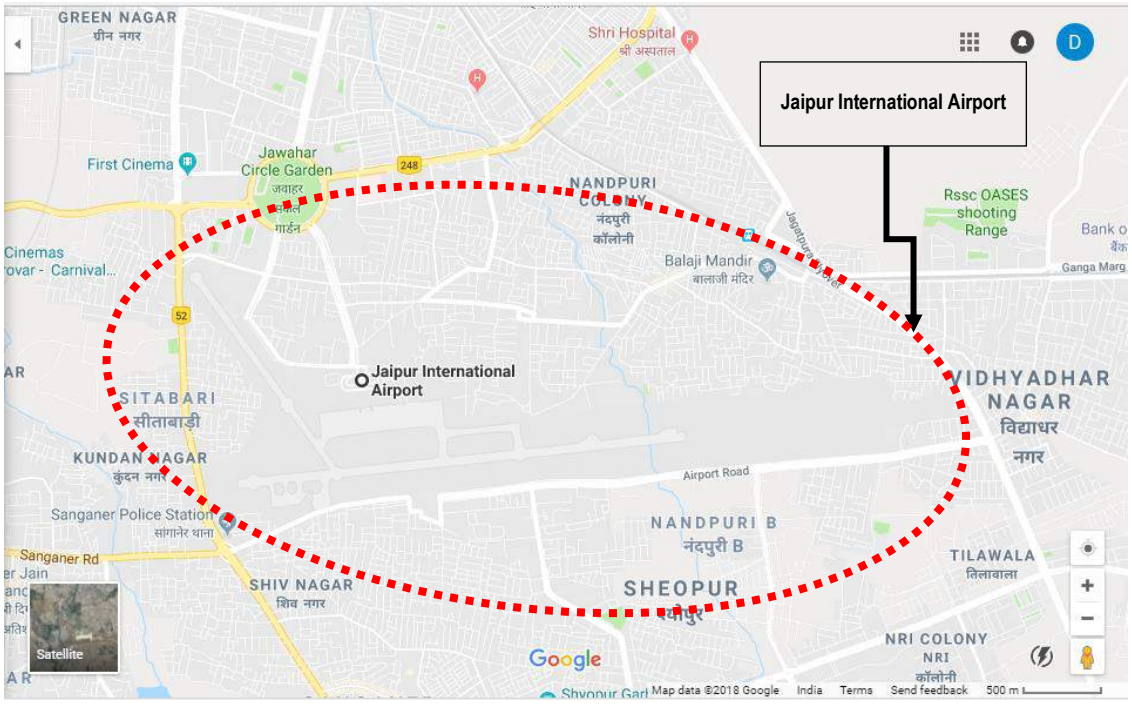


Figure 3-1: Surroundings of Jaipur Airport in Sanganer, Jaipur District, Rajasthan

3.3 PHYSIOGRAPHY

The expansion site for AAI Jaipur International Airport is designated in the Jaipur Master Plan 2025. The expansion site is paved area. The highest elevation and the lowest elevation of the study area are 598 AMSL and 352 AMSL respectively. The site is flat terrain of average 385 AMSL. The northeast part of the study area is occupied by Jhallana Ban Reserve Forest, which is 4km away from site.

Jaipur district is characterized by wide spectrum of landscapes including hillocks, pediments, undulating fluvial plains, aeolian dune fields, ravines, palaeo-channels etc. Structural hills (mainly in northern and northeastern parts) trending NNE-SSW are generally composed of Delhi quartzite. Main peaks include Jaigarh (648mamsl), Nahargarh (599mamsl), Manoharpura (747mamsl) and Bichun (656mamsl). Pediments with thin to thick soil cover can be seen around Dudu, Phagi and Chaksu forming flat gneissic outcrops. Undulating plains of fluvial/ fluvial-aeolian origin forming landforms of river terraces, floodplains and buried channels of various drainage systems dominate in the district. Aeolian sand dunes are found mainly in western parts (Sambhar, Jobner, Renwal area) which are a few metres to 10m high. Obstacle and shadow dunes can also be seen in parts of the district in addition to ravine and badland topography at places. The district area is drained by ephemeral rivers Banganga, Bandi, Dhund, Mendha, Mashi, Sota and Sabi and their tributaries. Sota and Sabi rivers in the northern part of district flow northeasterly while southwesterly flowing Banganga river passes through Shahpura, Bairath and Jamwa Ramgarh blocks and contribute water to the famous Ramgarh lake from where it flows easterly to enter Dausa district. Mendha River in northwest portion of the district merges with famous Sambhar lake whereas Mashi river in the southwestern part flows easterly.[2]

3.4 HYDROGEOLOGY[1]

Groundwater in the district occurs both in unconsolidated Quaternary formations and consolidated formations of Bhilwara and Delhi Super Groups and also Post Delhi Granites. In greater part of the district, alluvial deposits comprising of mainly fine sand and silt serve as potential aquifers in addition to gravel zones as encountered at Sanganer, Ambabari, Bajaj Nagar (Jaipur city) and Shahpura, Dhanauta, Nayan, Kalyanpur, Mohana and Chandalai. Groundwater at shallow depth occurs under water table condition and under semi-confined conditions at depth. Talus and scree deposits at foothills form potential aquifer at places including Banskho in Bassi block and parts of Amber, Jamwa Ramgarh and Govindgarh blocks. Yield of wells in these formations ranges from 100 to 500 m3/day. Hard rocks of Bhilwara Super Group, comprising of granulitic gneisses, quartz mica schist, phyllite along with granite and pegmatite intrusives, form main aquifers in southern and south western parts of the district in Dudu, Phagi and Chaksu blocks. Similarly, quartzite, schist and phyllite of Delhi Super Group form aquifers in Jamwa Ramgarh, Bairath, Kotputli, Shahpura, Amer and Bassi blocks. Movement of groundwater in these hard rocks is controlled by size, continuity and interconnectivity of weathered and fractured parts and other secondary porosities. Depth of wells in the district generally varies from 50 to 100m in alluvium and 50 to 200m in combination/consolidated formation areas. Specific capacity of wells varies from 58 to 500 lpm/m. Transmissivity value and storage coefficient varies from 10 to 850m^2/d and 4.70 x 10^{-5} to 1.05x 10^{-3} respectively.

[2] Source: CGWB Ground Water Information Booklet, Jaipur District, Rajasthan, 2013

3.5 GROUND WATER STATUS[1]

During premonsoon period (May, 2011), depth to water levels varied from 7.08 mbgl at Dawach in Sambhar block to 84.00 mbgl at Chomu in Govindgarh block. Deeper water levels of more than 40 mbgl were recorded in the central part of district covering most parts of Govindgarh, Shahpura Amer, Jothwara and Sanganer blocks. Shallow water level less than 10 mbgl has been recorded in the southwestern part of the district mostly in the blocks of Dudu and Phagi.

During postmonsoon period (November, 2011), depth to water level varied from 4.15 mbgl at Rasala, Jamwa Ramgarh block to 82.8 mbgl at Chiomu, Govindgarh block. Water levels more than 40 mbgl were observed in the central parts of the district covering blocks of Govindgarh, Amer, Jotwara, Sanagner and Bassi. Shallow water level less than 5 mbgl were registered in the south-western parts of the district in Dudu and Phagi blocks.

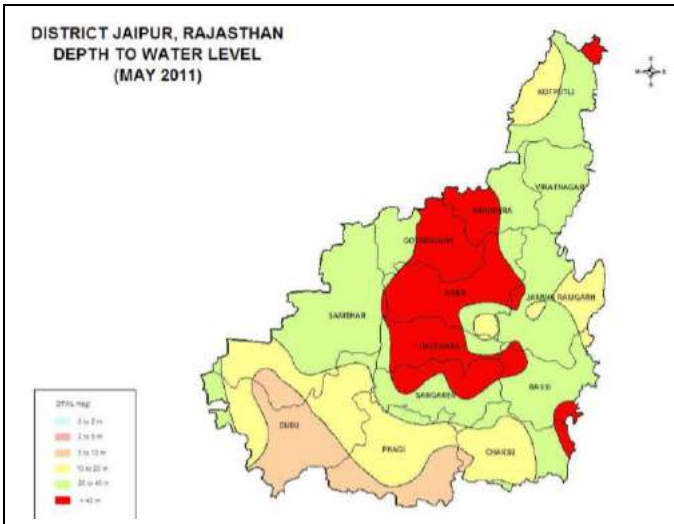


Figure 3-2: Depth to Water Level (Premonsoon- May 2011)

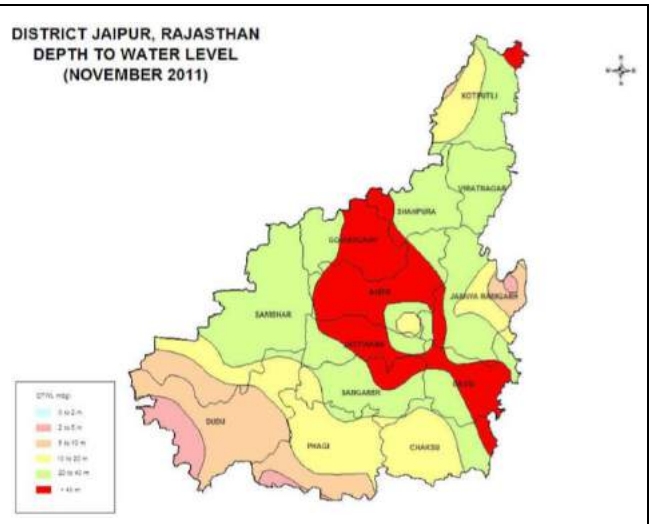


Figure 3-3: Depth to Water Level (Post-monsoon- November 2011)

3.6 LAND OWNERSHIP

The land of the airport is under the ownership of AAI.

3.7 TOPOGRAPHY

The highest elevation and the lowest elevation of the study area are 598 AMSL and 352 AMSL respectively. The site is flat terrain of average 385 AMSL. The northeast part of the study area is occupied by Jhallana Ban Reserve Forest, which is 4km away from site.

3.8 EXISTING LAND USE PATTERN

As per the Master Plan of Jaipur 2025, the landuse is designated for Airport.

3.9 EXISTING INFRASTRUCTURE

Jaipur Airport has an area of 776 acres (~314 Ha.) and a single runway with orientation 09-27, and dimension of 3407 m x 45 m. The Existing Terminal building is serving both Domestic and International Passengers. The

apron has a capacity of 21 bays presently, of which, 2 bays are 'in-contact' bays serving the Domestic Passenger Terminal Building.

3.10 METEOROLOGY & CLIMATOLOGY

Meteorological factors such as wind speed, direction variation in temperature, humidity etc. play a direct role in dispersion and dilution of pollutants. Other factors such as terrain and local topography also take part in atmospheric dispersion. This section makes a comparative analysis of the meteorological condition of the study area. The data used for the purpose are the 20 years average IMD data.

3.10.1 Climatic Condition (30-years IMD Data, Jaipur (Sanganer))

Total mean annual rainfall for the period 1970-2000 of the Jaipur is 635.4 mm. Summary of 30 years average data is presented in the table 3.1 below:

Table 3-1: Climatological data of IMD Jaipur

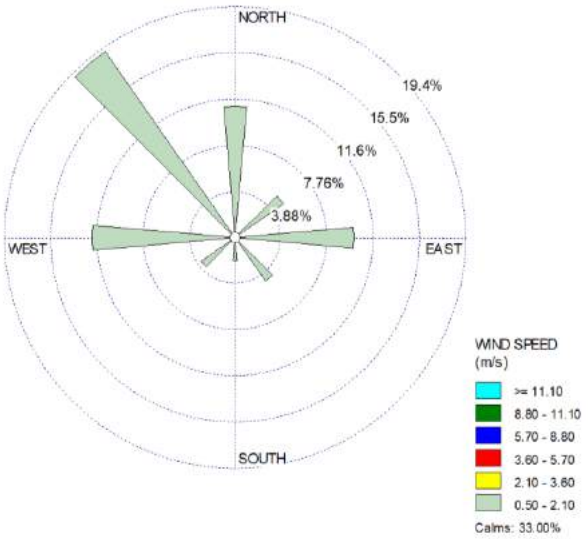
Sl. No.	Parameters	Description of the Season				
1	Rainfall in mm	Total Annual Average Rainfall is 635.4 mm				
		Winter (Dec to Feb)	**Months**	**Total rainfall (in mm)**		
			December	4.2		
			January	7.0		
			February	10.6		
			Total	**21.8**		
		Summer (Mar to May)	March	3.1		
			April	4.9		
			May	17.9		
			Total	**25.9**		
		Monsoon (June to Sept)	June	63.4		
			July	223.3		
			August	205.9		
			September	66.3		
			Total	**558.9**		
		Post-Monsoon (Oct to Dec)	October	25.0		
			November	3.9		
			December	4.2		
			Total	**33.1**		
2	Temperature (Mean Daily Temp. in ^{0}C)		**Months**	**Max**	**Min**	**Avg**
		Winter (Dec to Feb)	Dec	24.4	9.2	16.8
			Jan	22.4	8.4	15.4
			Feb	25.0	10.8	17.9
			Average	**23.9**	**9.5**	16.7
		Summer (Mar to May)	Mar	31.0	16.0	23.5
			Apr	37.1	21.8	29.5
			May	40.3	25.9	33.1
			Average	**36.1**	**21.2**	28.7
		Monsoon (June	June	39.3	27.4	33.4

Sl. No.	Parameters	Description of the Season				
		to Sept)	Jul	34.1	25.8	30.0
			Aug	32.4	24.7	28.6
			Sep	33.8	23.3	28.6
			Average	**34.9**	**25.3**	30.1
		Post-Monsoon (Oct to Dec)	Oct	33.6	19.4	26.5
			Nov	29.2	13.8	21.5
			Dec	24.4	9.2	16.8
			Average	**29.1**	**14.1**	21.6
3	Relative Humidity in per cent	Winter (Dec to Feb)	**Month**	**08.30 hrs**	**17:30 hrs**	
			Dec	64.0	38.0	
			Jan	66.0	35.0	
			Feb	58.0	28.0	
			Average	**56.3**	**27.3**	
		Summer (Mar to May)	Mar	45.0	19.0	
			Apr	32.0	16.0	
			May	35.0	18.0	
			Average	**37.3**	**17.7**	
		Monsoon (June to Sept)	Jun	51.0	32.0	
			July	75.0	61.0	
			Aug	80.0	67.0	
			Sep	69.0	49.0	
			Average	**68.8**	**52.3**	
		Post-Monsoon (Oct to Dec)	Oct	51.0	30.0	
			Nov	53.0	32.0	
			December	64.0	38.0	
			Average	**56.0**	**33.3**	
4	Wind-speed	Winter (Dec to Feb)	**Month**	**Speed (kmph)**		
			Dec	3.3		
			Jan	3.9		
			Feb	4.8		
			Average	**4.0**		
		Summer (Mar to May)	Mar	5.6		
			Apr	6.6		
			May	8.9		
			Average	**7.0**		
		Monsoon (June to Sept)	Jun	8.8		
			July	7.5		
			Aug	7.2		
			Sep	6.4		
			Average	**7.5**		
		Post-Monsoon (Oct to Dec)	Oct	4.4		
			Nov	3.4		
			Dec	3.3		
			Average	**3.7**		

Source: Climatological Table 1951 – 1980, Indian Meteorological Department, Govt. of India, New Delhi

The wind rose for the entire year is given below:

Figure 3-4: Annual Wind Rose Diagram



Annual

Source: Climatological Table 1951 – 1980, Indian Meteorological Department, Govt. of India, New Delhi

3.11 SEISMICITY

Entire Rajasthan is divided into 3 seismic zones v.i.z. Seismic zone II, III and IV. The project site falls under seismic zone II which is a low damage risk zone. This factor has been taken into consideration and all the buildings will be constructed as per IS 4326, IS 13827, IS 13828, IS 13920 and IS 13935 to ensure that all the buildings are earthquake resistant.

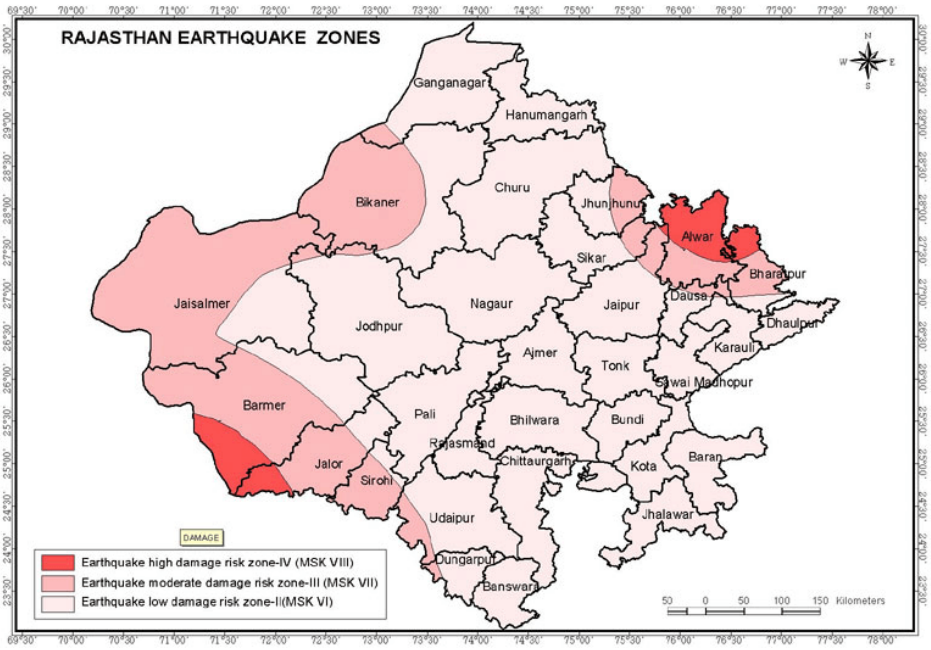


Figure 3-5: Seismicity Map of Rajasthan

3.12 WIND HAZARD

Almost the entire area of Rajasthan falls under High Damage Risk Zone (Vb=47m/s) of wind hazard, southern part of the district falls under Moderate Damage Risk Zone (Vb=44m/s). The project site falls under High Damage Risk Zone (Vb=47m/s) of wind hazard. The following mitigation measures will be undertaken to minimize the effect of wind hazards.

- Building strong engineered structures to withstand wind speed.
- Proper plantation will be developed to prevent soil erosion.
- Future critical facilities will not be located in areas of accelerated winds.
- The roofs of existing critical facilities should be retrofitted to a higher standard to ensure wind resistance.
- Building openings such as windows and doors also suffer damage from high velocity winds.
- These openings if not constructed of wood or metal should be protected with shutters or temporary covers of adequate design

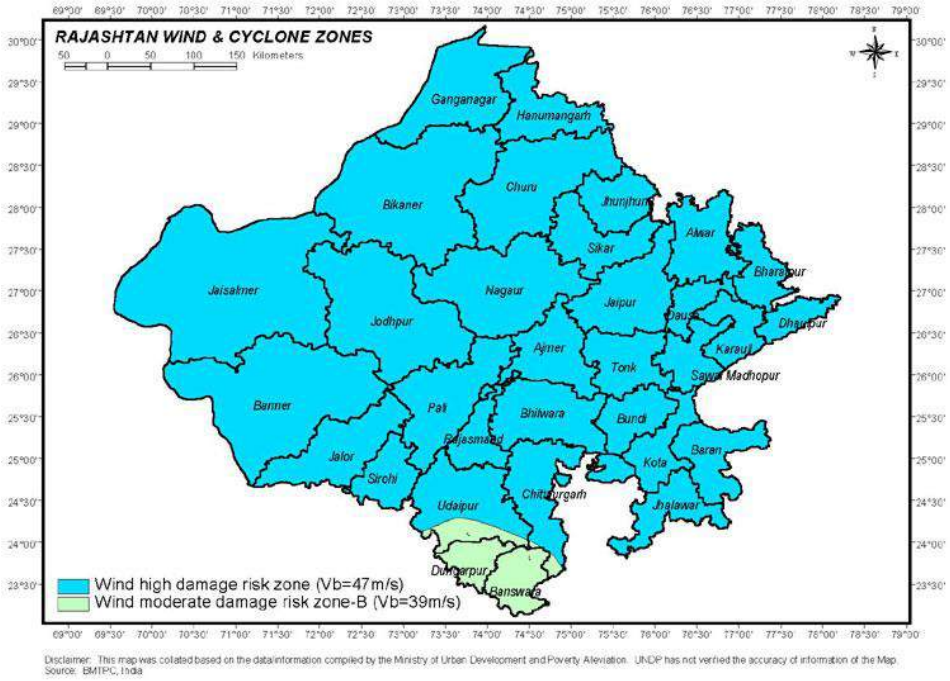


Figure 3-6: Wind Hazard Map of Rajasthan

4 . PLANNING CONSIDERATION

4.1 PLANNING CONCEPT

The Concept Plan for the proposed expansion defines the scope of the proposal and the development of facilities in accordance with the requirements of traffic. Earlier discussion on Traffic Analysis and Project Sizing are used as the basis for planning of the various components.

It is the overall objective of this effort to produce a balanced airside and landside complex to serve forecast aviation demands. The primary goal of the Master Plan is to define a development concept which allows for the airport to be marketed, developed, and safely operated for the betterment of the region and its users. With this in mind, the following development objectives have been defined for this planning effort:

- Maintain an attractive, efficient, and safe aviation facility in accordance with government, state, and local regulations.
- Develop facilities to efficiently serve general aviation users and encourage increased use of the airport, including business and corporate activity.
- Provide sufficient airside and landside capacity, efficiency, and safety through additional facility improvements which will meet the long term planning horizon level of demand for the airport and region.
    - Identify any future land acquisition needs.
    - Ensure that any recommended future development is environmentally compatible.
    - Enhance local economic development through maximizing the use of available property.

4.2 POPULATION PROJECTION

The integrated terminal will cater to 5000 passengers in peak hour, since the growth trend indicate a total traffic of 10 million international and domestic passengers by 2025/2026.[3]

4.3 LAND-USE PLANNING

The land-use planning of the airport is given in **Table 4.1**.

Table 4-1: Proposed Land-use Planning (Proposed Area Statement)

Built-up area of proposed Terminal Building (Including 20,000 Sqm Basement and 18750 Sqm of	1,25,000 m^2

[3] Source: AAI Jaipur

Retail/Commercial/Retiring Rooms and Airlines Offices)	
Built-up area of proposed Multi-level Car parking (Considering 2000 Car Parking of Size 2.5m x 5m) a. 2000 Car x (2.5m x 5m) = 25,000 Sqm b. 20% Vehicle Movement Area = 5,000 Sqm c. 10% Facilities/Booths/Services = 2,500 sqm	32,500 m^2
~ Landspace Area	26,987 m^2
~Area under Roads and Proposed Elevated Road	74,646 m^2
TOTAL	**2,59,133 m^2 (64 acres)**

4.4 ASSESSMENT OF INFRASTRUCTURE DEMAND

As per current traffic data the domestic passengers handled are 38,05,711 for year 2016-17 and 47,86,103 for year 2017-18. As per traffic projections done, the passenger traffic will increase to 10 million per annum by 2025-26.

The existing building capacity is saturated; therefore, it is proposed to expand the passenger terminal building to cater to the passengers' convenience considering future growth of Jaipur Airport.

4.5 AMENITIES/FACILITIES

The amenities and facilities inside the airport includes parking facilities, small retail outlets etc.

4.6 SUMMARIZED PROJECT FACILITIES & AREA DETAILS

Project facilities & area details for existing are summarized below in **table 4.2**.

Table 4-2: Summarized facilities at proposed Airport

S. No.	Description	Existing	Proposed
1.	Aerodrome Reference Code	4D	E
2.	Design Aircraft	Boeing 747-300	Boeing 747-300
3.	Flights per hour	12 aircrafts	18 aircrafts
4.	Passenger Terminal Capacity (million per annum)	3.5	10
5.	Runway (orientation & dimension)	09/27 3407m x 45m	09/27 3407m x 45m
6.	Turning Pads	Available	Available
7.	Taxiway	A: 23m x 72m B: 23m x 18m C: 23 x 27m D: 23m x 67m S: 23m x 91m	A: 23m x 72m B: 23m x 18m C: 23 x 27m D: 23m x 67m S: 23m x 91m

S. No.	Description	Existing	Proposed
		T: 45m x 67m	T: 45m x 67m
8.	Parallel Taxiway	M: 23m x 100 R: 23 m x 100m	M: 23m x 100 R: 23 m x 100m
9.	Apron	758*140 (106120 SQM) Excluding old bays 1-7)	758*140 (106120 SQM) Excluding old bays 1-7)
10.	RESA	240 m x 150 m	240 m x 150 m
11.	Isolation Bay	On Tango taxi 87*87 Mtrs Dumble used as Isolation bay	On Tango taxi 87*87 Mtrs Dumble used as Isolation bay
12.	Shoulders		
a.	to Runway	7.5 m	7.5 m
b.	To Taxiway	7.5 m	7.5 m
c.	To Apron	7.5 m	7.5 m
d.	To Isolation Bay	7.5 m	7.5 m
13.	Terminal Building sqm	Built up area: 22,500 m^2	Built up area: 1,25,000 m^2
14.	Cargo/Admin building (Terminal I)	2,396 (1831.85 Parking area)	2,396 (1831.85 Parking area)
15.	Residential Area	7,587 m^2	7,587 m^2
16.	Engineering Office	343 m^2	343 m^2
17.	ATC Tower (33m ht)	693 m^2	693 m^2
18.	Sewerage Treatment Plant	1200 m^2	1200 m^2
19.	Fuel Farm/Oil Company	BPCL: 4089 m^2; HPCL: 904.8 m^2; IOC: 3346 m^2; Reliance: 1600 m^2 (+2000)	BPCL: 4089 m^2; HPCL: 904.8 m^2; IOC: 3346 m^2; Reliance: 1600 m^2 (+2000)
20.	M.T. Section (full form)	2519.3 m^2	2519.3 m^2
21.	Fire Station	892.13 m^2	892.13 m^2
22.	NTB (full form)	2061.4 m^2	2061.4 m^2
23.	MI Room (full form)	663.5 m^2	663.5 m^2
24.	New Power House	592.5 m^2	592.5 m^2
25.	Surface Car Parking (250 cars)	16072.8 m^2	-
26.	Surface Bus Parking (8)	600 m^2	-
27.	Multi-level Car Park	-	32,500 m^2
28.	Pathway area + road network	52000 m^2	74,646 m^2
29.	Landscaping City side	25000 m^2	26,987 m^2

S. No.	Description	Existing	Proposed
30.	Number of Gates	3	3
31.	Estimated Electrical Load	2.25 MVA	10 KVA
32.	Sub Station equipment along with HT & LT distribution network	√	√
33.	Building Electrification and Area Lighting	√	√
34.	Central Air conditioning of terminal building	√	√
35.	X-Ray Baggage Scanner (inline), Door Fitted Metal Detectors and Hand Held Metal Detectors	√	√
36.	Baggage Conveyor.	√	√
37.	Non-illuminated Retro Reflective Sign Boards inside the building and outside side developed are	√	√
38.	Sliding doors, Water Coolers Hand Driers	√	√
39.	Close Circuit Surveillance System (CCTV) (IP based)	√	√
40.	Public Address System (IP based)	√	√
41.	Flight Information Display System	√	√
42.	ATC communication equipment	√	√
43.	Automated Weather observation system	√	√
44.	Revolving Beacon	√	√
45.	Landing T / H indicator	√	√
46.	Airfield Ground Lighting (AGL) in interleaved circuit.	√	√
47.	Simple & CAT – I approaches	√	√
48.	Apron High Mast lighting	√	√
49.	Navigation equipment / system	√	√
50.	ASSR / MSSR	√	√

5 . PROJECT INFRASTRUCTURE

5.1 INTRODUCTION

The Jaipur Airport Concept Plan allows for the construction of a domestic airport for capacity of 10 million passengers per annum approximately. The primary goal of the Master Plan is to define a development concept which allows for the airport to be marketed, developed, and safely operated for the betterment of the region and its users. With this in mind, the following development objectives have been defined for this planning effort:

- Maintain an attractive, efficient, and safe aviation facility in accordance with government, state, and local regulations.
- Develop facilities to efficiently serve general aviation users and encourage increased use of the airport, including business and corporate activity.
- Provide sufficient airside and landside capacity, efficiency, and safety through additional facility improvements which will meet the long term planning horizon level of demand for the airport and region.
- Identify any future land acquisition needs.
- Ensure that any recommended future development is environmentally compatible.
- Enhance local economic development through maximizing the use of available property.
- Identify opportunities for approved non-aeronautical use of certain areas on the airport to further diversify airport facility revenue generating potentials.

Fundamental capacity constraint of any airport lies in the runway system. Runway capacity puts a natural limit on the capacity enhancement possibilities of any airport. Though, in the present case the capacity needs of the airport may not be an issue of significance due to the low activity anticipation, experience suggests that most of the airports which are facing acute capacity constraint now, were low activity airport at the beginning. Therefore, it is advisable to address the capacity issue during each planning exercise without being influenced by the anticipated traffic volumes.

Therefore, as per best planning practices “an approach from whole to part” is proposed so that an evaluation of the most realistic and best uses of airport property is made while factoring local development goals, physical and environmental constraints, and appropriate airport design standards.

Any development proposed by a Plan evolves from an analysis of projected needs. Though the needs were determined by the best methodology available, it cannot be assumed that future events will not change these needs.

The Plan for Jaipur Airport is a futuristic plan and considers the aircraft i.e. Boeing 747-300 and Code E, the horizon period is till year 2025. It is proposed to be implemented in a phased manner and primarily constitutes of two functional areas: airside (runways, taxiways, navigational aids, etc.) and landside (general aviation, hangars, aprons, terminal area, cargo facility etc.). Within each of these areas, specific facilities are required or desired. The developments are proposed to be planned for the medium horizon period i.e. 2025.

5.2 AIRSIDE INFRASTRUCTURE

5.2.1 Expansion of Existing Terminal Building:

Construction of centrally air-conditioned Integrated Passenger Terminal Building of an area 1,25,000 Sq.m. (excluding 22,500 Sq.m area of existing Terminal building) and basement area of 20,000 Sq.m.. Considering the fast growing air traffic and demand for better passenger facilities an area of 18,750 Sq.m. is to be kept for retail /commercial outlets / retiring rooms and airlines offices to tap future potential at the Airport. The building is to be provided with aesthetically appealing & soothing interior decoration matching the modern structure. Space planning to ensure that no dead Space/ Area is created in the building.

In the Terminal building, Departure area, Arrival area, Security hold area and Concourse area are to be provided with adequate nos. of toilets for gents, ladies and differently-abled persons and drinking water. Suitable number of ramps is to be provided for entry and exit of differently-abled persons in departure and arrival area. Provision of battery operated buggies for senior citizens / differently-abled persons as per requirement.

The design of Terminal building will include Media planning, Retail area planning, F & B plan, etc. Overall planning of Building will capture local architectural features and it will be part of design features of terminal. The design should include the required arrangement for its regular maintenance so as to make it in-built part of execution. Solar power generation viz solar lighting, solar roofing system, etc. will be provided. Maintenance friendly roofing & building façade system including provision of regular cleaning with maintenance hoists, hooks, etc. including cat walk / rope suspended platform / gondola etc. will be provided.

5.2.1.1 Departure Area

The integrated Terminal building with provision of Departure concourse, Check-in area with adequate number of Check-in counters, Immigration counters, Custom counters, Foreign Exchange counters, office space for Custom and Immigration, back- up offices for airlines, baggage conveyor belts, facilitation counter, weighing machines, counters etc.

5.2.1.2 Security Hold area

Security Hold area with Aerobridges and Bus Lounge with adequate seating arrangements and separate security check & holding area and associated facilities.

The passenger frisking area in Security Hold with adequate space for locating required number of DFMDs, frisking platforms, inspection table for manual checking of hand baggage and adequate space / rooms for security staff. X-ray machine for hand baggage, isolated Smoking area with proper ventilation in the security hold area.

Duty free / Retail Area Creation of Retail Islands/ Shops without affecting the passenger movement, Food& Beverage Area.

5.2.1.3 Arrival Area / Baggage Claim Area

The Integrated Terminal building with provision of adequate immigration counters and Custom counters, Foreign Exchange counter. Baggage Claim Area shall have adequate number of Baggage Conveyor Belts of

adequate size to be provided, space for storing baggage trolleys, mishandled baggage and counters / space for airlines and back up offices, and associated facilities.

Adequate space should be provided in the ground floor for required number of, back- up offices, and space for storing baggage trolleys, space for storage of mishandled baggage for airlines, office for Immigration, Custom and Quarantine.

Provision of Information counter & Pre-paid Taxi counter.

Canopies of appropriate size to be built to cover Baggage make-up and Break-Down area.

5.2.1.4 Common Concourse Area

Common concourse area in the ground floor to have provision for snack bar, travel requisite, Bank / ATM, post office, TR and Curio stall, drinking water, Meet-and-Greet area, first-aid room, facilitation counters, space for care taker office with store, Terminal Manager office with supporting office for AAI and airlines, Conference Room and other facilities at suitable location.

5.2.1.5 Miscellaneous Facilities

- Airport Director's office with associated office space, conference hall, retiring rooms, toilet for staff to be provided.
- Construction of multilevel car park with all amenities for at least 2,000 cars and surface parking for VIP cars &10 buses, Separate car / scooter park area for AAI and airlines staff at appropriate location. Multilevel car parking to be made for retailer in car parking area & it has to be developed on Built & Operate System and shall include its space planning and model for its operations.
- Development of four-lane vehicular road from Terminal Building / Car parking with canopy covering two lanes in front of the Terminal Building on the city side and connecting the main approach road to the city.
- Provision of VIP/CIP lounges, with adequate number of chairs, furniture, furnishings etc in the departure lounge common concourse, check-in area, and security hold area and arrival lounge.
- Provision of water supply system including pumping arrangement, Water Filtration, water cooler & R.O/U.V. Filters, Sewage Treatment Plant (STP) and Effluent Treatment Plant (ETP) as per norms and as per site conditions.
- Horticulture-landscaping, drainage system, water supply, rain harvesting etc.
- Driver's canteen and toilet facility on the city side.
- Sub-station, A/C plant room and related service facilities. Provision should be made for the AC Plant Room vertical shafts through AHU rooms, backup generators for essential services, etc. in the lower ground floor.
- Provision of acoustics for effective functioning of PA system.
- Providing city side compound wall depicting local architecture and with proper gates.

5.2.2 ELECTRICAL WORKS:

- roads.
- Augmentation of main power supply, Substation Equipment, DG Sets for Secondary Power supply and associated ancillary buildings.

- Provision of central air-conditioning & ventilation (HVAC) system & BMS for New Terminal Building.
- Provision of conveyor belts with In-line Baggage System and other equipment at departure area and inclined carousels at Arrival hall.
- Provision of fire detection & alarm system, provision for fire hydrants and water sprinklers system as per standards along with fire extinguishers.
- Escalators, Travellaters & Elevators with matching staircase.
- Provision of Passenger Boarding Bridges (PBB) for the specified parking stands.
- Provision of automatic sliding doors at exit and entry points of terminal.
- Provision of adequate number of Signage of world class standard, inside and outside the terminal building, car park area & City side approach road and air side area for guidance of passengers and visitors.
- Provision of Solar power for internal water requirement.

5.2.3 AIRPORTS SYSTEMS:

- Public address system and car calling system.
- Surveillance Close circuit TV system (SCCTV) and provision of adequate number of close circuit TV monitors, in the Security Control Room, Terminal Manager Room, APD Office etc.
- Provision of Flight Information Display System (FIDS) with adequate number of Display Devices in departure, arrival and security hold area for passenger facilitation.
- Provision of adequate number of X-ray machines for scanning Registered Baggage (RB)/ Hand Baggage (HB), including provision of required number of ETDs, DFMDs & HHMDs, as per BCAS norms.
- Provision of adequate no. of VHF FM Sets (Walkie-Talkie, Base Stations & Mobile Stations).
- Provision of Telephone Exchange / digital EPABX/ IP EPABX system for Terminal Building including telephone/ intercom instruments, wiring etc.
- Provision of CUTE, CUPPS and CUSS Systems.

5.2.4 ITSYSTEMS

- Passive and Active networking components such as OFC, UTP cabling, Routers, Core & Access switches and accessories. Provision of Raceways, cable trays, and conduit & cabling.
- Server room and adequate space for keeping network switches along with electrical power points & UPS.
- Access Control System as per BCAS requirement.
- Provision of Internet, VPN bandwidth, Wi-Fi system.

All the works are to be carried out as per DGCA, BIS / ICAO documents. Green building norms to be followed for four star ratings of GRIHA.

5.3 ASSESSMENT OF INFRASTRUCTURE DEMAND

5.3.1 Water Requirement & Supply

The project will utilize the water supply from ground water. The daily consumption of water during operation phase will be about 1512.5 KLD of which ~810 KLD will be fresh water and ~702 KLD will be recycled water.

5.3.2 Wastewater Management

Treated waste water shall be mainly used for landscaping and flushing. Efforts will be made to fully utilize the waste water to eliminate the risk of land or water contamination. The main source of drainage generation will be the discharges from toilets (water closet), urinals, sinks, pantry's, kitchen and other similar utilities The total wastewater generation in operation phase will be 926 KLD and that during construction phase is 80 KLD. The wastewater will be treated in 1,110 KLD MBBR technology STP.

5.3.3 Solid Waste Management

During construction phase solid waste will be collected and disposed as per established laws and Procedures. The Organic waste will be treated at site.

During the operation phase, twin bin waste collection system– green bins for bio-degradable wastes and blue bins for non-biodegradable wastes shall be provided. Waste collection shall be done on a door to door basis, and temporarily stored at identified locations before disposing as per established laws and procedures at Jaipur Municipality waste disposal site.

Hazardous waste shall be treated in accordance with Hazardous Waste Management Rules 2008, Batteries waste shall be handled in accordance with Batteries Management Rules, 2010 and E waste as per E-waste Guidelines, 2008.

5.3.4 Parking

The parking for cars is provided for the proposed project. The project parking area will be utilized during the arrival and departure of the flight. It is proposed that the proposed parking will fulfill the requirement for up to 2025 year.

6 . REHABILITATION & RESETTLEMENT PLAN

6.1 INTRODUCTION

The project does not involve any rehabilitation activities.

7 . PROJECT SCHEDULE & COST ESTIMATE

7.1 INTRODUCTION

The proposed completion schedule for the project is 57 months, from 12.01.2018 i.e. 09 months for pre-award stage, 36 months for execution & 12 months for DLP. The estimated cost of the project is ₹1470 crores. The budgetary cost estimates for the project have been prepared as per following details.

7.2 QUANTITIES

Quantities of the runway pavements, buildings, electrical works, navigational equipment's and other associated works for development of the airport at Jaipur are calculated based on preliminary planning, design and assessment of requirements based on codes and specifications. Detail designs not done at this stage

7.3 RATES

The rates of pavement work items have been prepared based on Rajasthan SOR 2016 duly enhanced for prevailing cost index. The cost estimates for buildings are based CPWD plinth area rates duly enhanced for prevailing cost index. Additional provisions for superior specifications have also been made in the estimate. The estimates of remaining items / facilities are based on market enquiries.

7.4 CONTINGENCIES

For the purpose of estimation, Contingencies @ 3% of the total cost of the works has been added.

7.5 GST FOR GOODS[4]

GST ranges from 0.25% to 28% depending on the category of goods.

7.6 LABOUR CESS

Labour Cess @ 1% of the total cost of the project (including contingencies) is applicable on construction projects all over India. However, the same has not been included in the cost estimates being a statutory government levy.

7.7 GST RATES OF SERVICES FOR CONSTRUCTION COST[4]

GST @ 18% with no refund of accumulated ITC is applicable on construction projects all over India. However, the same has not been included in the cost estimates being a statutory government levy. *(Construction of a complex, building, civil structure or a part thereof, intended for sale to a buyer, wholly or partly (the value of land is deemed to be one-third of the total amount charged for such supplies))*

7.8 PROJECT MANAGEMENT COSTS

For the purpose of estimation, no consultancy charges for design and PMC have been added.

[4] Source: https://www.aai.aero/en/important-links/gst downloaded on 30 May 2018

7.9 PRICE ESCALATION / VARIATION

No price escalation has been added in the estimates as the financial analysis has been done on NPV basis.

7.10 COSTS NOT INCLUDED

The cost of land acquisition, rehabilitation (if any), environmental mitigation (if any), obstruction removal as proposed in the report, utility shifting from the proposed Airport site, WCT, Labour Cess, service tax on construction cost, escalation, consultancy for design and PMC (including applicable ST/Cess) and cost of Fire tender/ambulance etc. has not been included in the estimate.

The preliminary cost estimate is placed below in Table **7.1**

Table 7-1- Estimates of project

S.No.	Year	Expenditure in Crore ₹
1.	2016-17	1.00
2.	2017-18	50.00
3.	2018-19	500.00
4.	2019-20	525.00
5.	2020-21	365.51

Source: AAI

8 FINAL RECOMMENDATIONS

8.1 INTRODUCTION

Airports Authority of India has planned to expand Jaipur International airport, as the airport is reaching its full capacity. The increased air traffic comprises of both the domestic and international passengers, for economic purposes and tourism and heritage places such as Amer Fort, Hawa Mahal etc. in Jaipur and also other tourism destinations in Rajasthan. The airport will be developed for operation of B-737-300 aircrafts in all weather conditions. Development of airport will be influence the growth of industries.

Airports Authority of India has planned expansion of the existing operations at Jaipur Airport by constructing the following:

- Expansion of Existing Terminal Building
- Construction of Airport Director's office
- Construction of multilevel car park
- Development of four-lane vehicular road from Terminal Building / Car parking
- Driver's canteen and toilet facility on the city side
- Sub-station, A/C plant room and related service facilities
- Construction of Boundary Wall with gates

The Existing Terminal building is serving both Domestic and International Passengers. The existing terminal building has handling annual capacity of 3.5 mppa and the proposed terminal building will have capacity of 10 mppa. The airport is developed for operation of Boeing 747-300 similar aircrafts in all weather conditions.

Recognizing the exponential growth of air traffic in India, the Rajasthan State government has planned to expand the Jaipur Airport. The general evaluation of the site indicates following:

- ✈ Land provided by State Govt. free of cost and without encumbrances after removing of obstructions like diversion of road, HT & LT lines and road passing through airport premises and approach funnel.
- ✈ Land has already been handed over to AAI by the state Government.
- ✈ Adequate access exists to sources of bulk services including water, power and telecommunications.

In summary, the site appears to be feasible for expansion of Jaipur International Airport.