PRE-FEASIBILITY STUDY FOR THE DEVELOPMENT OF
AYODHYA AIRPORT

1. Introduction
Existing airport at Ayodhya has a runway 12/30 of 1500m x 30m and is currently catering to
flying club activities and non-schedule operations by small aircrafts.
A MoU has been signed in February 2014 between GoU and AAI for development of
Ayodhya airport.
Accordingly, AAI has carried out a techno-economic feasibility study and obstruction
limitation survey for development of Ayodhya Airport. As per DPR, the airport is proposed to
be developed in 02 phases. In Phase-1 for operation of ATR-72Q-400 type of aircraft and
subsequently for A-320 in Phase-II.
Further, on request of State govt., a multi-disciplinary team of AAI visited Ayodhya airport for
pre-feasibility study for development of Ayodhya Airport for the operation of wide body
Aircrafts from 05.12.2019 to 06.12.2019

2. Present Status:
The operational statistics of Ayodhya Airport are given as under:

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Land</td>
<td>177.62 Acres</td>
</tr>
<tr>
<td>City population</td>
<td>0.23 Million (As per census 2011)</td>
</tr>
<tr>
<td>Aerodrome elevation/ AERO reference Temp.</td>
<td>100M/37C</td>
</tr>
<tr>
<td>Runway Orientation/Designation</td>
<td>12/30</td>
</tr>
<tr>
<td>Dimension</td>
<td>1500 M x 30 M</td>
</tr>
<tr>
<td>Suitable for</td>
<td>-</td>
</tr>
<tr>
<td>Runway surface (PCN/LCN)</td>
<td>-</td>
</tr>
<tr>
<td>Runway Shoulders</td>
<td>NA</td>
</tr>
<tr>
<td>Area of Terminal building</td>
<td>NA</td>
</tr>
<tr>
<td>Handling Capacity (Peak Hour)</td>
<td>NA</td>
</tr>
<tr>
<td>Total Handling Capacity (in MPPA)</td>
<td>NA</td>
</tr>
<tr>
<td>Apron</td>
<td>50M X 50M suitable for 01 Small Aircraft (code-B)</td>
</tr>
<tr>
<td>Navigations Aids</td>
<td>NA</td>
</tr>
<tr>
<td>ATC Watch Hours</td>
<td>NA</td>
</tr>
<tr>
<td>Scheduled Airline Operators</td>
<td>NIL</td>
</tr>
<tr>
<td>Destinations/ Movements</td>
<td>NIL</td>
</tr>
</tbody>
</table>
The team along with Airport Director Lucknow met the Principal Secretary at Lok Bhawan, Lucknow on 05.12.2018. The Principal Secretary informed AAI team that the existing airport at Ayodhya is required to be upgraded as modern airport to accommodate aircraft having capacity of 180-190 passengers. He had further informed that 850 acres of land is being acquired for upgrading the existing airport at Ayodhya and proposed that AAI may take over Ayodhya airport for operations as State Government has no expertise in Airport Operations. He has assured that land for upgradation of airport will be provided free from all encumbrances and proposal to this effect will be forwarded separately.

During the discussion Principal Secretary was briefed by AAI team on various identified obstacles and penetrations in the Obstacles Limitation Surfaces (OLS). The surfaces are mainly penetrated by NHAI flyover at National Highway-28, Cellphone masts, chimneys, trees and high-tension lines which may affect the extension and upgradation of existing airport. In Runway 12 approach, the highest elevation of flyover is 109-28 meters without considering the mobile vehicular movement. As the flyover was built on National Highway by NHAI the height of 8m mobile vehicle will be added. Accordingly, Principal Secretary was informed that physical extremity of the runway 12 will require to be shifted by 90m-1000m for safe aircraft operations. Hence the proposed extension of Runway and upgradation of airport may be considered after shifting the existing extremity of the Runway 12. The Principal Secretary was also informed about penetration in OLS by buildings, chimneys and high tension lines in the surrounding area of the airport. On this issue, Principal Secretary has assured that the buildings, chimneys and high tension lines will be dismantled and trees, if required, will be removed/pruned.

2.1 Inspection of Ayodhya airport and its vicinity.

The multi-disciplinary team from CSHQ along with State Govt officials visited the existing Ayodhya airport. The observations are as under:

(i) Ayodhya Airport is located at 70 NM west of Gorakhpur (IAF) Airport, 68 NM east of Lucknow Airport, 81 NM north-east of Allahabad (IAF) Airport and 86 NM north-west of Varanasi Airport. Due to all these operational airports being on the proximity of 68-46 NM of Ayodhya Airport, the movement of aircrafts to and from Ayodhya airport may be subjected to some operational constraints (Design of Standard Instrument Departure (SID)/S) Standard Arrival Route (STAR)/ Instrument Approach Procedure (IAP)).
(ii) Danger Area VIDI 36 (Malha) with altitude up to 19000 ft. is located in North West of Runway 12/30 and lies in the approach funnel of Runway 12. To the south east of airport just 7 NM (12km) away lies the boundary of Gondalpur flying area. The airport is located in an area already constrained by Air Force local flying area and danger area located in the immediate vicinity of the airport.
(iii) Local flying areas of (a) Parbatganj VIR 152 A, (b) CTA of Lucknow, (c) Sultanpur VIR 152 B will impact the operations.

Air Space Restrictions due to danger/ restricted areas are as detailed below:
- Danger Area VFD 136 (Nalbha) is located 3.7 NM north-west of Falahabad.
- Restricted Area Gorakhpur (VER 75 A) is 7 NM from Falahabad.
- ATC routes can be designed connecting the airport from Lucknow and other nearby airport. However, there will be access limitations due to proximity of danger area VFD 136 and restricted area VER 75 A.
- Release of air space from MOD up to 30 NM all around the airport for the design of Instrument Approach Procedures.

(iv) Required clearance from MOD shall be taken.

Subject to the above prerequisite, it appears that design of instrument approach procedures at this proposed site will be feasible as per requirement and standards of ICAO DOC-8168.

(v) In GSR 751-E two runway having orientation 11/29 (1815x45m) and 05/23 (1429x45m) are published, whereas existing runway orientation is 12/30 and length is 1900x36m (paved area 1680m approx.). The cleared runway 23 towards north of runway 30, about 129-130 m from intersection point was handed over to Awasan University by State Government. The building structure of Awasan University was found under construction and accordingly State Government Officials were informed that height of building for Awasan University must be restricted immediately in accordance with GSR-751E and the University may be advised to obtain NOC for permissible height.
(vi) The Runway surface is in very poor condition and FOD in form of loose pebble are noticed on entire length of the runway.

(vii) The entire runway strip is undulated with thick mud/sedimentary rocks.

(viii) The entire runway strip is full of vegetation and long grass.

(ix) The wildlife animals (Nilgai/Blue bull, Cows & buffalos) were found grazing on the runway strip inside the operational area.
In transitional surface of Runway 12, thickly populated residential area adjacent to airport boundary wall was noticed at both sides (North & South). Hence, the transitional surface for runway 12 is not found protected, according to the provision of GSR 751-E for obtaining NOCs. The height of structure/building/cellphone masts within the radius of 15 km have not been restricted by the state Government.
(i) The flying club hangar at north of runway 12 is found at distance of 90 from runway centerline and penetrating in the transitional surface.

(ii) The entire approach surface of Runway 30 has dense forest with group of trees upto 100m from boundary wall.

(iii) The dense forest with long group of trees in transition surface south of Runway 30 approximately upto 400m from boundary wall was also noticed.
3. Planning Concept

The development and upgrade of Ayodhya airport is based on aviation demand as per the Master Plan. The proposed development is to be carried out in two phases. Facilities such as terminal building, runway, taxiways, airport supporting facilities, roads, power etc. are considered in the master plan.

3.1. The primary focus on development of Ayodhya Airport will be

- Capacities are built ahead of the traffic demand
- Capacity of Airside, Terminal, Landside and Support facilities are in sync and balanced.

3.2. Airside Facilities

Airbus 321 will be the critical design aircraft for considering the design standards for runway, taxiways, apron and other facilities in phase I.

The aircraft wingspan dimension of 36m (for separation of apron and taxi lanes) and length 45m is adopted for planning of new apron and taxiways.
In Phase-II, B-777-300 will be the critical design aircraft for considering the design standards for runway, taxiways, apron and other facilities.

The aircraft wingspan dimension of 65m (for separation of apron and taxi lanes) and length 75m is adopted for planning of new aprons and taxiways.

3.3. Upgradation and Development of Airport for Code 'C' type of aircraft

In the domestic sector Air India, Indigo and Go Air operates Airbus 320/321 or ATR -72 and Spice Jet operates B-737-800 or Q-400 code 'C' type of aircraft. Airbus 320/321 carries 180/220 passenger, B-737-800 carries 184 passengers, ATR-72 carries 70 passengers and Q-400 carries 86 passengers.

For calculating the required runway length for code 'C' type of aircraft, the following parameters is to be considered:

i. Aerodrome Reference Temperature
ii. Runway Field Length Requirements for intended aircraft
iii. Take-Off Weight Limitations for intended aircraft
iv. Runway Width Requirements for intended aircraft

Runway Field Length Requirements and Take-Off Weight Limitations are taken from generic Original Equipment Manufacturers (OEM) provided documentation and need to be validated against Aircraft Operating Manual (AOM).

Aerodrome Reference Field length required for different aircrafts have been provided in ICAO doc 9981 PAP Aerodrome. However, it has also been stated in the guidance material that Reference field length should not be used for the design of aerodrome runway length, as the required length will vary depending on various factors such as aerodrome elevation, reference temperature and runway slope.
3.4. Runway Length calculation for proposed Ayodhya Airport

3.4.1. Airbus 321 aircraft

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Airbus A 321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest weight variation Maximum Take off Weight</td>
<td>93000 Kg</td>
</tr>
<tr>
<td>Aerodrome Reference Field Length</td>
<td>2500m</td>
</tr>
<tr>
<td>Aerodrome Elevation</td>
<td>100m</td>
</tr>
<tr>
<td>Aerodrome Reference temperature</td>
<td>37°C</td>
</tr>
<tr>
<td>Elevation correction in Runway</td>
<td>2500 x 0.07 x 100/500 + 250 = 2558 m</td>
</tr>
<tr>
<td>Temperature correction in Runway</td>
<td>2558 x (37-15) x 0.01 + 2558 = 3128 m</td>
</tr>
</tbody>
</table>

The minimum Runway length (without slope correction) of 3128m will be required for A-321 operation at Ayodhya airport.
3.4.2. Airbus 320 aircraft

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Airbus A 320</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest weight variation</td>
<td>Maximum Take off</td>
</tr>
<tr>
<td>Weight</td>
<td>77000 Kg</td>
</tr>
<tr>
<td>Aerodrome Reference Field Length</td>
<td>1900m</td>
</tr>
<tr>
<td>Aerodrome Elevation</td>
<td>100m</td>
</tr>
<tr>
<td>Aerodrome Reference temperature</td>
<td>27°C</td>
</tr>
<tr>
<td>Elevation correction in Runway</td>
<td>1900 x (27 x 100/300 + 1900 = 1944 m</td>
</tr>
<tr>
<td>Temperature correction in Runway</td>
<td>1944 x (27-15) x 0.01 = 1946 - 2371.68 m</td>
</tr>
</tbody>
</table>
### 3.4.3. B-737-800 aircraft

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Boeing B-737-800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest weight variation</td>
<td>Maximum Take-off</td>
</tr>
<tr>
<td>Weight</td>
<td>79016 Kg</td>
</tr>
<tr>
<td>Aerodrome Reference Field Length</td>
<td>2300 m</td>
</tr>
<tr>
<td>Aerodrome Elevation</td>
<td>100 m</td>
</tr>
<tr>
<td>Aerodrome Reference temperature</td>
<td>37°C</td>
</tr>
<tr>
<td>Elevation correction in Runway</td>
<td>2300 x 0.7 x 100/500 = 2300 ÷ 2353 m</td>
</tr>
<tr>
<td>Temperature correction in Runway</td>
<td>2353 x (0.7-0.5) x 0.61 + 233 = 2870 m</td>
</tr>
</tbody>
</table>

The minimum Runway length (without slope correction) of 2870m will be required for B-737-800 operation at Ayodhya airport.
3.5. Upgrade and Development of Airport for Cote ‘E’ type of aircraft

3.5.1. B-777-300 aircraft

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Boeing B-777-300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest weight variation</td>
<td>Maximum Take off</td>
</tr>
<tr>
<td>Weight</td>
<td>351200 Kg</td>
</tr>
<tr>
<td>Aerodrome Reference Field Length</td>
<td>3000m</td>
</tr>
<tr>
<td>Aerodrome Elevation</td>
<td>100m</td>
</tr>
<tr>
<td>Aerodrome Reference temperature</td>
<td>37°C</td>
</tr>
<tr>
<td>Elevation correction in Runway</td>
<td>300 x .07 x 100/300 + 300 = 3070 m</td>
</tr>
<tr>
<td>Temperature correction in Runway</td>
<td>3070 x (17-45) x 0.01 + 300 = 3745 m</td>
</tr>
</tbody>
</table>

The minimum Runway length (without slope correction) of 3745 m will be required for B-777-300 operation at Ayutthaya airport.
3.6. Proposed Master Plan

* Phase-I for operation of A-321 type of aircrafts.
  - Runway of dimensions 3125m x 45m
  - RESA 240m x 90m
  - RWY strip 3245m x 280m
  - Visual Aids for 24hr operation
  - Navigational aids for safe operation while approaching, landing or take off from Airport
  - Additional land required: 463.10 Acres.

* Phase-II for operation of Code E (B777, 300ER), wide body aircrafts.
  - Runway of dimensions 3750m x 45m
  - RESA 240m x 90m
  - RWY strip 3870m x 280m
  - Additional land required: 122.87 Acres.

3.7. Runway Capacity Scenarios

In Phase-I, the existing Runway is proposed to be extended to meet the operational requirement of Airbus 321 alongwith taxiway connected to Runway and apron. The proposed Runway along with Taxiway would serve 12 Aircraft movements per hour. In Phase-II, the Runway capacity would be increased with parallel Taxiway and Runway proposed to be further extended to meet the operational requirement of wide-bodied Aircrafts (Boeing B-777, 300ER).

3.8. Runway Strip and Runway End Safety Area

DGCA, Civil Aviation Requirements, Section-4, Aerodrome Standards & Licensing, Series 'B', Part 1 provide Standard for 280m wide Runway Strip and 240m long Runway End Safety Area for Code 3 Instrument Runways. Accordingly, 280 m. width of Runway Strip and 240 M. long Runway End Safety Area (RESA) is proposed in compliance of DGCA CAR.
3.9. Parallel Taxiway

In order to improve efficiency and enhance safety, DGCA, Civil Aviation Requirements provides standards for separation between Parallel Taxiway centre line and Runway centre line.

The parallel Taxiway at a distance of 172.5m is proposed in Phase-II to reduce the runway occupancy time. The Proposed parallel Taxiway will increase the runway capacity to accommodate more landing and departure.

3.10. Aircraft Stands and Apron Layout

Aircraft parking stands will be designed to accommodate up to Airbus 321 type of aircraft and in sync with capacity of Terminal Building. The minimum clearances between an aircraft entering or exiting the parking stand and any adjacent building, aircraft on another stand and other objects of 4.5m is retain according to DGCA, Civil Aviation Requirements. Fuel hydrant system shall be installed to serve the parking stands. The sufficient wing tip clearance between aircraft to accommodate the staging and maneuvering of passenger busses and other GSE necessary to support aircraft processing shall be provided. The stand requirements are split between operational stands and non-operational/remote stands.

3.11. Visual Aids

Visual aids on Runway, taxiways and aprons to ensure that aircraft can operate safely on a 24 hours basis are considered. In Phase-I, visual aids to meet the requirement of category-I Precision/non-precision Runway are proposed in compliance to DGCA CAR, Aircraft Operations, Section-A, Series C, Part-1. In Phase-II Visual aids to meet the category-II and Category III B precision approach Runway are proposed.

3.12. Navigational Aids

Navigational Aids to secure the safe operations of aircraft when approaching, landing or take off from the airport are considered. DVOR/ DME is proposed at a distance of 220 m from runway centerline. In phase-II, ILS instrument is proposed to cater the operations under category II and III-B.

3.13. Passenger Terminal Building

Performance or Level of Service (LOS) criteria are the primary drivers for various functional elements in the terminal. International benchmarks and best in class practice has been adopted for assessing terminal requirements. The needs of facilities such as check-in and security etc. are considered for designing the terminal building.

The proposed terminal building consists of two modules of 75,000 sqm, each which can be developed in stages depending upon the passenger traffic demand. First module will be able to cater 5.0 million passenger per annum (MPPA) for Phase-I and after the construction of second module, the total capacity of the terminal building will be 10 MPPA Phase-II.

3.14. Car parking

Ample space for Car Parking at 100 m away from Terminal Building to meet the BCAS requirement has been made in the Master Plan for Phase-I and Phase-II requirement.

3.15. Aircraft Rescue and Fire Fighting

ARFF facilities and their access routes are the most location-critical support facilities. The DGCA Standards for ARFF response time is 2 minutes to the end of each Runway and 3
minutes to any other part of the movement area. ARFF station is proposed to meet the DGCA standards and will have housing provisions for 3 CFT and 1 ambulance to cater category-6 requirement for Airbus A-321 type of Aircraft and space for future expansion to cater the requirement of Code E type of Aircraft.

3.16. ATC Tower
Site has been identified in the Master Plan for the construction of ATC Tower to cater operation of narrow body aircraft in Phase-I and wide body aircraft in Phase-II.

3.17. Fueling Station
Provision for fuel yard (AFS) also made in the Proposed Master Plan for storage of at least 5 days’ fuel reserve based on average daily demand. The fuel station has to be developed considering the future expected demand by next 15 years. The fuel hydrants system will be implemented in a sprin to avoid fuel spillage, vaporization loss and vehicular emissions.

3.18. Cargo Terminal
Provision of Cargo Terminal with aircraft parking stands are proposed in the Master Plan which will be developed as per requirement.

3.19. Hangars
Provision of hangars has been proposed in the Master Plan, which will be developed as per requirement.

3.20. Service Yard
Space identified in the Master Plan.

3.21. Landscape Area
Any public space should be envisaged as a harmonious coexistence of built & un-built spaces. Landscape plays a vital role in adding to the beauty of built spaces. Provision of 100m wide strip in front of Proposed terminal building made for landscape area.

3.22. Commercial Area
To make the business model of the Airport sustainable, sufficient area has been marked in the master plan for commercial utilization to increase the non-aeronautical revenue of the airport.

3.23. Residential Area
For development of a Residential Complex for accommodating the operational and security personnel, State Govt. to identify approx. 15 acres of land near to Airport.

3.24. Approach Road
The State Govt. to provide 4-lane approach road from the nearest highway for smooth flow of traffic to and fro from the Airport.

3.25. Administrative Area
An administrative area has been marked in the master plan for administrative use of AAI, DGCA, BCA etc.

3.26. Energy
Use of renewable energy and solar PV with Zero Metering facility by GoUP for capacity enhancement will be considered in an energy resources optimization programme. The solar power plant will help in minimizing the dependency on electricity supplied by the Grid.
4. CONCLUSION:

On analysis of the site of the airport, it can be conclusively said that due to presence of Flyover on the Highway in the approach path of Runway 12, physical extremity of the runway 12 will require to be shifted by 900-1000m for safe aircraft operations. In order to safe aircraft operations, 463.10 Acres of land will be required in Phase – I for operation of A – 321 type of Aircraft. Additional 122.87 Acres of land is required in Phase – II for operation of B777-300ER type of Aircrafts. Moreover, 15 acres of land will also be required near to Airport as residential area for operational and security personnel.

Further State Authorities shall immediately promulgate the control of construction activities with respect to height in the vicinity of Airport in accordance with provision prescribed in GSR75(I(E). State authority shall also obtain required clearance from MoD to release air space upto 30 NM all around the airport for designing of Instrument approach procedure.

Fresh OLS survey need to be carried out w.r.t the proposed master plan for all the phases of development and all the obstacles identified in the OLS survey shall be removed for safe and efficient operation of Airport before developing the airport for A-321 type of aircraft operations in Phase-I and B-777-300 type of aircraft in Phase-II.

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