

Istanbul New Airport ESIA

Analysis of Alternatives

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4 Analysis of Alternatives

4.1 Introduction

The IFC Performance Standards on Social and Environmental Sustainability (Ref. 4.1) specify the requirements for the assessment of feasible alternative configurations for a project:

"For greenfield developments or large expansions with specifically identified physical elements, aspects, and facilities that are likely to generate potential significant environmental or social impacts, the client will conduct a comprehensive Environmental and Social Impact Assessment, including an examination of alternatives, where appropriate."

"For greenfield developments, the ESIA includes an examination of technically and financially feasible alternatives to the source of such impacts, and documentation of the rationale for selecting the particular course of action proposed. The purpose of the alternatives analysis is to improve decisions on project design, construction, and operation based on feasible alternatives to the proposed project. This analysis may facilitate the consideration of environmental and social criteria at the early stages of development and decision-making based on the differences between real choices. The alternatives analysis should be conducted as early as possible in the process and examine feasible alternatives; alternative project locations, designs, or operational processes; or alternative ways of dealing with environmental and social impacts"

This chapter describes the Turkish government's approach to site selection and the approach to design selection alternatives introduced by IGA in response to the Turkish General Directorate of State Airports Authority (DHMI) reference design for INA.

During the analysis of alternatives the following topics were considered:

- Potential for the renovation and upgrading of existing airports;
- Increased capacities of other airports servicing the region;
- The closure of the existing airport;
- Possible alternative locations for a new airport; and
- No action alternative.

4.2 The Need for a New Airport

Ataturk International Airport is the main international airport in Turkey. It was opened in 1924 and was located at the time approximately 24 km west of the City of Istanbul. The airport was renamed Ataturk International Airport in 1980. In 2012, Ataturk International Airport was the twentieth busiest airport in the world and the sixth busiest airport in Europe. The airport has three runways, a domestic and an international terminal.

In 2013, the airport handled a total of 51.3 million passengers: 17.2 million domestic passengers and 34.1 million international passengers. It handled 388,000 air traffic movements (ATMs): 127,000 domestic ATMs and 261,000 international ATMs. This equates to 14% growth on 2012 passenger figures and 12% growth on 2012 ATMs (Ref. 4.2).

The world transfer passenger share for Istanbul has increased from 15% in 2008 to 39% in 2013. The primary home based carrier, Turkish Airlines (THY), has more than trebled in size to become one of the top ten International Air Transport Association (IATA) member airlines by international traffic. The second largest Turkish airline, Pegasus, has also enjoyed high levels of growth, with a current fleet of 45 aircraft, and combined orders and options of another

100. The Istanbul international air traffic network is currently characterised by extensive links to Europe and the Middle East, supported by long-haul services (to both east and west) and extending south into Africa (Ref. 4.3).

Currently, Ataturk International Airport is operating at or beyond its maximum capacity (considered to be 45 mppa). To increase the capacity of the existing Ataturk Airport to around 90 mppa, there would be a requirement for an additional runway and another terminal building to be constructed and it is believed that expansion is constrained by urban and highway development neighbouring the airport. Based on the trend of rising passenger and air traffic movements to and through Istanbul and the desire to be recognised as a major hub for international air transport, the Turkish government has determined that action needs to be taken to increase airport capacity in the Istanbul region.

The European Bank for Reconstruction and Development (EBRD) reported that Turkey's air transportation market is under penetrated, representing only 10% of the total passenger traffic in Turkey (Ref. 4.4).

In addition, Turkey has introduced a strategy to significantly expand its rail network by 2023. This includes plans for 10,000 km of new high speed rail lines and 5,000 km of new conventional rail lines. With regard to the road network, in 2011 there were approximately 21,68o km of divided highways and by 2023 the Ministry of Transport expects there to be 36,500 km (Ref. 4.4).

4.3 Considerations for Expanding Istanbul Airport Capacity

The Turkish government identified in 2003-2004 that Ataturk International Airport was reaching its capacity and that plans were required to address this situation. In the past ten years, the government has been reviewing the alternatives regarding to allow for increased capacity in international and domestic air travel through Istanbul. The geographical location of Istanbul has been identified as a potential world hub for international travel.

The Anatolian and European sides of Istanbul are considered as two separate cities due to their geographical separation which have been compounded by extreme traffic congestion. To cater for this geographic separation, two airports have been constructed. Sabiha Gokcen International Airport serves the Istanbul Anatolian side and Ataturk International Airport serves the Istanbul European side. To realise the aspirations of Istanbul as an international hub, several options have been reviewed. These include:

(i) Expansion of the existing Ataturk International Airport;
(ii) Lengthening of the runway servicing military forces at Ataturk International Airport;
(iii) Expansion of Tekirdag/Corlu Airport and connection to Istanbul via a light rail system;
(iv) Expansion of Sabiha Gokcen International Airport; and
(v) Construction of a new airport on the European side of Istanbul.

The two main alternatives which were identified as having the potential for further study were the expansion of Ataturk International Airport and the construction of a new airport on the European side of Istanbul.

It should be noted that the site selection process has been wholly the responsibility of the Turkish government. The site selection and preliminary design were completed before the tender process in accordance with Turkish legal requirements. The government was required to finalise these processes before going out to tender. As such, IGA has not taken part in the site selection process.

4.3.1 Expansion of Ataturk International Airport

Ataturk International Airport (AIA) is Istanbul's largest airport, located on the European side, 24 km west of Istanbul. In 2013, it was reported to be handling 51 mppa, though its formal capacity is approximately 30 mppa.

Expanding the existing AIA was considered to be the least favourable of these options based on the fact that over time the continued westward expansion of the City of Istanbul has surrounded the airport resulting in the introduction of approximately 9,000 buildings or structures that present obstacles adjacent to the airport which would be difficult and costly to remove. These buildings or structures impede the expansion of the existing airport to the north, east and west. This option would also involve a significant social impact due to need of expropriation of urban developments. Additionally, the proximity to urban development introduces a high degree of safety risk associated with take-off and landing activities.

Notwithstanding this, it was announced in July 2014 that the operators of the AIA were in talks to build a new international terminal, which would increase capacity by 10 mppa. However, in light of the reasons set out above, as well as the limited cargo terminal capacities, aircraft stands and road connections (Ref. 4.6), further expansion beyond this is considered unlikely at AIA.

In respect to the potential to expand AIA onto land owned by the Turkish Military, the feasibility is dependent on negotiations between the AIA operator and the Turkish military. Current reports indicate that no agreement has been achieved. Furthermore, even if additional aircraft parking stands opened in the military area, it is considered likely that runway crossings would create significant difficulties and delays in the operations, thus limiting maximum capacity (Ref. 4.6).

4.3.2 Expansion of Tekirdag/Corlu Airport

Tekirdag Corlu Airport (TCA) is a military and public airport in Corlu, located approximately 100 km west of Istanbul. In 2008, the annual passenger capacity was 600,000 ppa and there were plans to establish a 'cargo village' adjacent to the airport (Ref. 4.7) as well as a light rail system to provide a connection to Istanbul.

It is considered that due the very limited existing passenger capacity, as well as the aspiration to develop the cargo handling capacity at TCA, further expansion of passenger capacity is considered unlikely to be at a scale which would be sufficient to meet Turkey's increasing demand.

4.3.3 Expansion of Sabiha Gokcen International Airport

Sabiha Gokcen International Airport (SGIA) is Istanbul's second international airport and is located on the Anatolian side, 35 km south-east of Central Istanbul. Almost 90% of the capacity is on local airlines and almost 75% on low-cost carriers (Ref. 4.8). In 2009, a new domestic/ international terminal was opened increasing the airport capacity to 25 mppa. In 2013, the airport catered for 18.8 mppa, an increase of 4 mppa from 2012 (Ref. 4.5); b. Furthermore, it is reported that a second runway will be built at SGIA to increase airport capacity to 50 mppa by end 2015/2016.

Due to its location on the east side of Istanbul at Pendik, and its cargo terminal with refrigerated warehouses, SGIA handles predominantly commercial flights; 88% of domestic flights and 89% of international flights handled at SGIA in 2012 were commercial (i.e. cargo) with only 23% of all air traffic comprising passenger traffic (Ref. 4.6). Although SGIA does not face any

immediate problems in respect of expansion, due to its location on the Anatolia side it is considered that, regardless of its passenger capacity, the SGIA is unlikely to attract significant passengers from the European region (Ref. 4.6).

4.3.4 No Action Alternative

Based on the increasing trend in air traffic passenger numbers arriving or transiting through Istanbul airports, it was considered that even if all new facilities/expansions at AIA, and SGIA are implemented, the airports in Turkey would be limited to approximately 100 mppa and therefore unable to cater for the increasing demand. As this would limit Turkey's air-traffic potential, it was considered unfeasible to take no action to further increase airport capacity to accommodate this rising trend.

4.4 Site Selection Process

During the site selection process, an area of approximately 1,200 km^2 (40 km x 30 km) was studied by the government. This involved the area between the Black Sea and the Marmara Sea. Several sites were evaluated within this study area, although no official report is available for reference due to the sensitivities associated with this Project and the possibility of land speculation (increasing land values).

It is understood that the main site selection criteria used during the studies were:

- Meteorological data (particularly wind speed and prevailing wind direction);
- Possible runway orientation and potential obstacles;
- Costs associated with land expropriation and construction;
- Environmental and social considerations, including potential noise and air quality impacts and the number of residential properties impacted;
- Existing infrastructure; and
- ICAO Annex 14 aerodrome safety requirements.

It is understood that the following considerations were taken into account by the government during the site selection process:

- Avoidance of settlement areas in order to reduce disruption and resettlement requirements;
- Ongoing and planned development projects within the study area; and
- Opportunities to provide integration with planned development projects within the study area, including consideration of the development plans for the Turkish State Railway, Istanbul Metropolitan Municipality, other municipalities within the study area (including Arnavutkoy and Eyup), and the development plans of the General Directorate of State Highways.

IGA was provided with a copy of an official letter from the Legal Consultancy Department of DHMI dated 24 April 2014 which sets out an official legal opinion in relation to the Project and includes some explanation regarding the site selection process which supports the information summarised above. The criteria and considerations included in the letter are summarised below:

- A statement that there is an urgent need for INA to be constructed in Istanbul as it is not possible to meet the increased demand for air travel through the expansion of with Ataturk Airport or Sabiha Gokcen Airport. Ataturk Airport served to 51.3 million

passengers and Sabiha Gokcen served to 18.5 million passengers in 2013, and these airports are at 98% terminal capacity. It is already difficult to meet the current aviation demand in Istanbul. Therefore, considering the increased demand for flights and the associated passenger traffic in the coming years, a new airport is considered to be essential and a priority.

- The targeted passenger numbers in Turkey in 2016 are 198 million passengers per annum and it is expected that more than 96 million passengers per annum will pass through Istanbul. At nearly 100% capacity as of 2013, Ataturk and Sabiha Gokcen Airports could not satisfy this increasing passenger demand.
- Ataturk Airport is located within the city centre and its expansion and development is constrained. Urban development around the airport is a barrier to expansion and forms an obstacle in terms of air traffic.
- A delay in the development of INA would lead to considerable financial loss and negatively affect the Turkish target of being one of the leading countries in the aviation sector and as such it is considered urgent that an expropriation decision is taken.
- Assessments regarding site selection for the Project were undertaken within the framework of ICAO Annex-14 criteria considering meteorological, topographical and navigation conditions. Within this process, Project site alternatives were assessed according to airspace planning, expropriation costs, existence of sufficient land capacity, landing and takeoff airspace requirements. Consideration was also given to the Istanbul 3rd Bridge and North Marmara Highway route with special attention being given to the Akpinar Region.

As a result of the above, studies in relation to INA were conducted in the Akpinar-Yenikoy Region by considering: distance to Ataturk Airport flight corridor; existence of sufficient land use; expropriation cost; access via the sea; proximity to the planned 3rd Bridge and North Marmara Highway route and lack of dense urban/rural development between airport location and the sea. The current land uses as mines and silt and clay quarries would limit the options for other investment or settlement proposal on this Site other than a public investment. The INA Project would result in the economic development of the region through the rehabilitation and reclamation of the area. Consultation Carried Out Under the Turkish EIA Process

The Turkish EIA Report provides details of the public consultation meeting that was held on 6 November 2012 in Tayakadin village in Arnavutkoy District. The meeting was attended by representatives from the MoEU, the Istanbul Provincial Directorate of Environment and Urbanization, the Directorate for Nature Conservation and National Parks, the State Meteorology Affairs General Directorate and the project owner, the Ministry of Transport, Maritime Affairs and Communications. Members of the public from the potentially affected communities were invited to the meeting via advertisements in the two national papers and one local paper.

During the meeting, the Project details, proposed Project Area and potential environmental and social impacts were presented. Details regarding the proposed expropriation process were provided and a question and answer session was held. No further detail is available regarding consultation activities undertaken as part of the site selection process. As indicated above, the site selection process was complete prior to IGA's appointment.

4.5 The Project Site

The selected Project Site covers an area of approximately 7,650 ha which represents an area that is almost eight times larger than Ataturk International Airport. The Site is considered to be suitable for a new airport development on the basis of:

- Wind conditions;
- Limited privately owned land and settlements within the area;
- Low land acquisition/expropriation cost;
- The Black Sea coast providing a northern boundary to the site allowing for take-off and landing over the sea thereby reducing the possibility of environmental and social impacts and future obstacles (buildings) being introduced;
- Existing road connections in the form of the Northern Marmara Motorway and the Ihsaniye to Tayakadin Highway (D-010);
- Compliance with existing aviation standards with regard to existing obstacles;
- Area not being completely covered by forestry;
- Existing industrial mining activity resulting in a historically degraded landscape;
- Opportunity to provide integration with foreseen development projects; and
- Limited availability of areas suitable for an airport close to the City of Istanbul.

The new airport location moves airport traffic and support services away from a heavily congested portion of the City of Istanbul and introduces a commercial economy to an area that is currently subject to heavy mining.

An element of the concession agreement includes the closure of Ataturk Airport to commercial airline traffic, which will reduce the existing environmental and social impacts of Ataturk Airport.

4.6 Master Plan Design Alterations

During the tendering process, DHMI provided bidders with a Reference Design for the planned airport (referred to here as the DHMI Reference Design). This Reference Design included an airport platform at 120 m above sea level to avoid impacts from existing or future obstacles. This level was planned to be achieved from fill of the Site from dredged sources (either from the proposed new canal Project in the Istanbul region and/or from dredging off the coast in the Black Sea). The development proposed six independent runways each with supporting taxiways; five with a north-south configuration and one located in the south eastern portion of the Project Area with an east-west orientation (Figure 4.1). The Reference Design planned for two terminals; one located in the north and one located in the southern portion of the Project Area; and two satellite terminals located between the two terminals. The Reference Design sets out that the northern terminal would be accessed via a highway that circumnavigated the western boundary of the airport.

During the tender submission process, the Consortium (now IGA) appointed Ove Arup & Partners International Limited (“Arup”) as Technical Advisor in support of the bid for the Concession to Build INA. The scope of work included a review of the earthworks strategy for optimising the platform and a review and assessment of the viability of the DHMI airport development plan.

Figure 4.1 DHMI Reference Design Site Layout for Istanbul New Airport

It should be noted that the east-west runway length has been shortened to avoid the Yukari Agacli Neighbourhood. However, the final decision regarding the status of the neighbourhood has yet to be confirmed by the Turkish government.

4.6.1 Earthworks Cut and Fill Volumes

It has been estimated that the construction of the DHMI Reference Design would require significant earthworks an order of magnitude greater than what was required to create artificial islands for airports such as Chek Lap Kok Airport in Hong Kong (Ref. 4.10). The main issue related to the DHMI scheme is the substantial fill demand (over 1 billion m^3 for Phase 1 (60% of the total earthworks), some of which the DHMI tender documents identified would be provided by the “Canal Istanbul” excavations. The nature, suitability and possible transfer rates to the airport from such a development were, however, not known. Therefore, Arup assessed alternatives, including a cut and fill balance option. The Arup study determined that this approach is considered to be the most efficient way to reduce the fill demand. This also results in a substantial reduction in the elevation to an average of 92 m above sea level (a lowering of approximately 30 m of the platform overall). This approach results in a large proportion of the cut material being used as fill material (a scenario dependent on the quality and suitability of the on-site material for use as fill). This reduces the fill volumes for Phase 1 to approximately 320 million m^3 (compared to initial estimates of 1 billion m^3). By altering the airport development plan to reduce the required fill volumes this reduces the need for sourcing and transporting large quantities of fill material from off-site locations and avoids the associated environmental impacts.

4.6.2 Terminal Locations

Within the amended Master Plan including new runway layouts and drawing (Ref. 4.11), the development plan (Figure 4.2) presents two terminal buildings located in the south of the Project Area along with a single satellite processor building located within the mid field area. This arrangement of terminals removes the requirement for a connecting highway to be built to allow passenger's access to Terminal 2 (located in the north of the Project Area in the DHMI reference design). This terminal configuration also removes the requirement for the additional 20 km vehicle journey from the D-010 - Ihsaniye to Tayakadin Highway road and Northern Marmara Motorway.

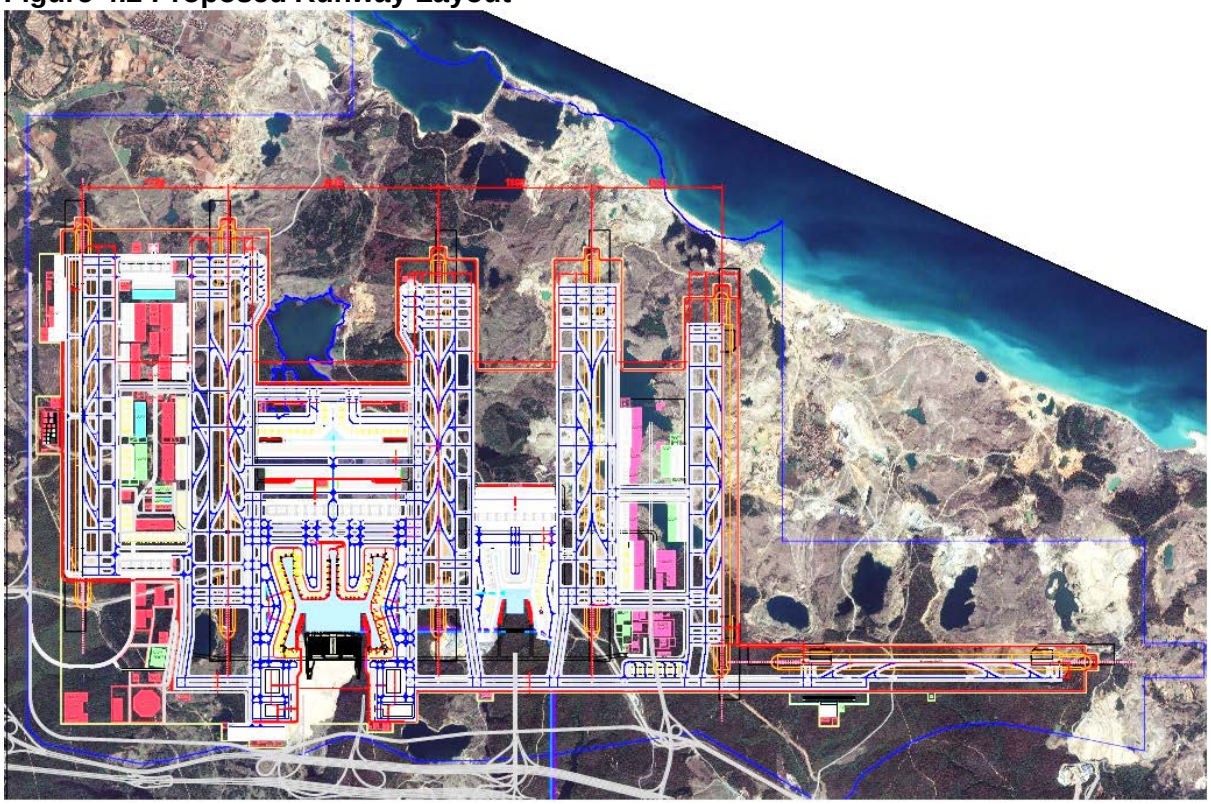
4.6.3 Runway Operating Modes

Potential runway operating modes have been identified based on the consideration of airfield geometry and airspace.

Runways 18R/36L and 18C/36C located on the western portion of the airfield (Figure 4.2) are separated by 1,700 m, and therefore can only be operated dependently, with one runway serving departures and the other arrivals. All other runways may be operated independently of each other and of the dependent pair. The independent runways could be operated in arrival, departure or mixed mode. In general, the preferred mode of operation is for the outside runways to operate as arrival only. This is due to the fact that taxi distances between the outside runways and the terminals are generally longer than between the inner runways and terminals. From a fuel burn point of view, it is better that heavier aircraft (departures with high fuel mass) have shorter taxi distances than lighter aircraft (arrivals with low fuel mass).

The proposed operating modes (Ref. 4.12) for the runways include a large proportion of take offs to the north over the Black Sea; reducing the potential noise and air quality impacts on properties located (currently and in the future) in the vicinity of the INA.

Figure 4.2 Proposed Runway Layout



4.7 Terminal Architectural Design Considerations

A concept design was prepared by Grimshaw Nordic for INA (Ref. 4.13). There is no specific brief from DHMI regarding detailed sustainability requirements in the concept design. However, in the Turkish EIA, which is an appendix to the contract with DHMI, it is stated that the terminal building will be designed as a certified green building. In addition, consideration is being given to the selection of technologies that can be used for airports in terms of:

- Reducing demand by building from:
  - Insulation of fabric to minimise winter heat loss and summer heat gain;
  - Area of glazing optimised to give good daylight without energy use;
  - Maximise daylight and energy using roof lights where remote from facades;
  - High performance glazing to minimise solar gains;
  - Airtight roof and façade to minimise air leakage;
  - Shaded facades to minimise solar heat gain on glass; and
  - Partial air conditioning of baggage hall by using exhaust air from terminal air conditioning.
- Reducing demand by use of efficient systems:
  - All air conditioning to be air displacement systems;
  - Use of free cooling with 100% use of outside air when conditions permit;
  - Heat recovery by thermal wheels;
  - Possible evaporative cooling on air inlet to air handling units;
  - Air intake from roof level to avoid use of energy intensive carbon filters;
  - Fan energy reduced by minimising duct lengths with low air velocities;
  - Pump energy reduced by minimising pipe lengths with low water velocities;
  - Low water fixtures;
  - Grey water recycling;
  - Recycling of condensate from air handling units;
  - Lighting control system;
  - High efficiency light sources and lighting designs;
  - Variable speed drives on fans and pumps; and
  - Electronic passenger control on lifts and travellators.
- Use of renewables:
  - Solar thermal heating of domestic hot water;
  - Rainwater harvesting;
  - Photovoltaics;
  - Wind turbines;
  - Sea water for heating and cooling;
  - Ground source heat pumps; and
  - Combined heat power and cooling.

The December 2013 Master Plan has been approved by DHMI in early 2014 and the concept design has been confirmed. The amended Master Plan for the new airport layout is currently

being developed which is discussed in more detail in **Chapter 3 Proposed Project and Project Description**. The detailed design has not been developed at this stage of the Project. Consideration has, however, been given to the potential environmental and social impacts associated with the options listed above.

References

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Ref. 4.11	Istanbul New Airport Master Plan, Ove Arup and Partners, December 2013 as amended in March 2015 (new runway layouts and drawing)
Ref. 4.12	NATS, New Istanbul Airport Version 1, 6 September 2013
Ref. 4.13	Grimshaw Nordic, Istanbul New Airport Concept Design, December 2013