Monterrey International Airport
Airport Design Evaluation
Fall 2009
Table of Contents

Introduction 3

History 3

Technical Description 4

Evaluation of Airport Design 7
  • Airport Design Standards (7)
  • A Third Runway at Monterrey International Airport (9)
  • Taxiway Circulation (12)
  • Walking distances (13)

Cargo at Monterrey Airport 15

Conclusion 17

Bibliography 17
Introduction

The Monterrey International Airport is the main aerial port of entry to the State of Nuevo Leon that serves the City of Monterrey and its metropolitan area of 3.8 million people (INEGI, 2005) and the third largest city in the country, after Mexico City and Guadalajara.

The Airport is located in the Municipality of Apodaca, Nuevo Leon and is considered as one of the most modern airports of Mexico and Latin America with a capacity of 8 million passengers per year. Up to 80% of the traffic is domestic and serves the cities of Mexico, Guadalajara, Chihuahua and Tijuana, and the rest 20% is international, serving the cities of Dallas, Houston, Atlanta, Chicago and Los Angeles.

It is considered the fourth airport of the country considering number of passengers per year, after the airports of Mexico City, the International Airport of Cancun and the International Airport of Guadalajara.

History

In 1998 Mexico starts a privatization process for the airports operations. The decision to privatize came directly from the Federal Government, the President, the Ministry of Transport and Communications and the responsible agency for the operation of airport services in the country, Aeropuertos y Servicios Auxiliares (ASA). The airports in Mexico were divided into four groups that were offered under concessions guaranteeing participants corporations, a profitable market. The bid was arranged for the most economically efficient airports, 35 of the 57 airports. Group South East (ASUR) with 9 airports, Pacific Group (GAP) with 12 airports, Center-North Group with 13 airports and Mexico City Airport by itself in a different group.

On this privatization scheme the State retains the 51% of the shares and each group functions as an independent corporation. The concessions were given for a limit period of 50 year. The groups have the opportunity to obtain social capital through the expedition of shares that can be sold in the international capital market.

General Mariano Escobedo International Airport (Monterrey International Airport) is part of the Center North Group. The total bid was 91 million dollars and a commitment to pay in the following 5 years 63.2 million dollars and by the year 2000, the 25% of the offer should be paid. In the year 2000, as part of the first stage of OMA's privatization, the Mexican government sold a 15% equity interest to Servicios de Tecnología Aeroportuaria (SETA), which is the strategic partner. SETA is owned by ICA, the largest engineering, construction and Procurement Company in Mexico, and Aéroports de Paris Management, a leading European airport operator. In 2006, OMA carried out an international IPO in which the government sold the balance of its shareholdings to the public.

The Mexican Ministry of Communications and Transportation (SCT) is the principal regulator of the airport operation business in Mexico. OMA's activities are principally
regulated by the Airports Law and their regulations and the General Law for National Assets, among other administrative laws.

As part of the concession agreement, OMA must meet stringent standards of safety and security, as well as service. Every fifteen years OMA must prepare master development programs (MDP) for each of the 13 airports and a detail of the expected growth in traffic over the following 15 years. Additionally, an investment proposal should be deliver to the Mexican government to serve this growth. Each five years the master plan has to be review and modify as needed. OMA's current MDP is for the period 2006-2010. During 2010, the SCT and OMA will negotiate the investment program and maximum rates for the 2011-2015 period.

The concessionaries for the other airport groups are: ASUR, Tribasa-Copenhagen Airpot A/S-Cintra Concesiones de Infraestructura-Groope GTM. The Pacific Group is being operated by Angeles Group and Spanish Airports (AENA), Grupo Dragados and Unión Fenosa.

Technical Description

The airport is located at a latitude 25.778489, 25° 46' 42.56" N and a longitude of -100.106878 100° 06' 24.76" W. It is at an elevation of 390 meters (1278 feet) over see level. It is an airport for civil operations and has two runways the 11/29 with a length of 3,000 meters (9,843 feet) in concrete and the 16/36 with 1,801 meters (5,909 feet) in asphalt. Fig 1.
The 11/29 runway counts on the instrument landing system (ILS) as a navigation aid for conducting precision approaches to an airport under low-visibility conditions. The runway 16/34 does not have ILS system.

The airport has three passenger terminals (A, B and C) and one cargo terminal. Terminal A counts on 9 contact and 12 remote positions and is considered the most modern air facility in the country (before the construction of Mexico City’s Terminal 2). It consists of two connected buildings, the first building accommodate the check-in facilities, baggage claiming, shopping areas, restaurants, customs, airport and airline offices, as many other services, and the satellite building is connected via an underground tunnel that comprises all the VIP and waiting lounges, migration among other services as well as the boarding gates. This satellite building is divided into two concourses, North Concourse for domestic flights (Gates A1-A15), while South Concourse comprises all the international flights that operate into the airport (Gates B3-B8). Fig. 2.

**Terminal A** is saturated. Several flights are delayed day by day due to the lack of free contact and even remote positions, as the ones capable of handling large aircraft such as the Boeing 767. Terminals B and C will work as a relief system for this terminal that has as well 9 jet ways positions. There are future plans to remodel and expand the Satellite building, adding at least 4 new jet ways and 3 remote positions.

**Terminal B** has 6 contact positions and 7 remote ones. The construction is now finished and it stated operations on September of 2009. It comprises 8 gates, 6 of which are equipped with jet ways and 2 apron-doors for the use of Aeromexico’s feeder airline Aeromexico Connect. The terminal is housing all operations of the Sky Team member airlines, similar to the Terminal 2 operations in Mexico City International Airport. This new airport terminal will be able to handle up to 4 million passengers per year, and will allow the airport to free some slots for new airlines to operate into Terminal A.

Fig. 2. Monterrey International Airport. Terminal Map.
**Terminal C.** An independent terminal that has 8 remote positions, this terminal houses some operations from low cost carriers serving the airport such as Viva Aerobus that became the first airline to operate.

**Cargo Terminal.** This independent terminal has 6 hectares for operations. Courier companies operating nationally and abroad, among them: FedEx, DHL, UPS, Estafeta.

OMA has the intention to create a new third runway, parallel to the actual largest one, the runway 11/29.

The airport handles up to 300 daily flights and 35 final destinations in Mexico, North America and Europe and is the distribution center of the airlines: Aviacsa, Aeromexico, Aeronmexico Connect and Viva Aerobus. In the year 2007 the airport transported 6.56 millions passengers and in 2008, 6.59 millions. Figure 3.

![Passenger Traffic 2008](image-url)
Evaluation of Airport Design

- Airport Design Standards

Airport Geometry and Runway Design

1. 11/29 Runway Length: 3,000 m
2. 11/29 Runway Width: 46 m
3. Taxiway and Apron Taxi Way Width: 39 m
4. 16/36 Runway Length: 1,801 m
5. 16/36 Runway Width: 49 m
6. Largest aircraft to handle: DC 10-30 Boeing
   Boeing 767
   Boeing 747-400

Evaluation of the Airplane Design Group

<table>
<thead>
<tr>
<th>Boeing 747-400</th>
<th>Boeing 767-400 ER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic Dimensions</strong></td>
<td><strong>Basic Dimensions</strong></td>
</tr>
<tr>
<td>Wing Span</td>
<td>211 ft 5 in (64.4 m)</td>
</tr>
<tr>
<td>Overall Length</td>
<td>231 ft 10 in (70.6 m)</td>
</tr>
<tr>
<td>Tail Height</td>
<td>68 ft 8 in (19.4 m)</td>
</tr>
<tr>
<td>Interior Cabin Width</td>
<td>20 ft (6.1 m)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC 10-30 Boeing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic Dimensions</strong></td>
</tr>
<tr>
<td>Wing Span</td>
</tr>
<tr>
<td>Overall Length</td>
</tr>
</tbody>
</table>

The Airport is planning to handle the Boeing 747-400 as the largest aircraft to be received. According to the Wing Span (WS) and the Tail Height (TH) of this the numbers are 64.4 m WS and 19.4 TH. In this report, Monterrey Airport will be revised according to the Airplane Design Group V and the geometry and runway design should be respectful of the FAA and ICAO regulations for this category. (Group V, Code E).

FAA Aircraft Classification

Group V: Wingspan 52 - < 65 m

ICAO Airport Reference Codes

Code E: Wingspan 52 – 65 m

According to the Airport Design (Advisory Circular AC 150/5300-13) prepared by the FAA.

**Design Requirements:**

- Runway Design: Group V: 45 meters (150 feet)
- Taxiway Width: Group V: 23 meters (75 feet)

**Current design conditions.** (Fig. 3 and 4).

- 11/29 Runway Width: 46 meters
- Taxiway Width: 39 meters

The result of this analysis is that Monterrey airport has been design according to the requirements established by FAA and ICAO.
The runway 16/36 it is used for general aviation purposes. At the same time it is important to mention that the 11/29 runway is being used for landings and take offs from southeast to northwest direction.
• A Third Runway at Monterrey International Airport

OMA has exposed on its Master Plan 2011-2015 that will develop and construct a third runway parallel to the main concrete runway 11/29 to the northeast. In this study, it will be revised and propose the separations that should be planed to fit the Airplane Design Group V category.

**According to the rule 207.** “Parallel Runway Separation for simultaneous VFR operations, the minimum runway centerline separation distance recommended for Airplane Design Group V runway is 1,200 feet (366 meters)”.

**According to the rule 209.** “Runway to Parallel taxiway and taxi lane separation. To have room for acute-angled exit taxiway, provide a runway centerline to taxiway centerline of at least 600 feet (180 m) for airplane design group V.”

In this case, the centerline separation between the taxiway and the runway is of 210 meters, and goes according to the FAA requirements. (Fig. 5.)

If the intention of the group is to add capacity to the airport and create a third runway and eventually even close, as a runway, the operations of the current 16/36, then, I believe it will be a good opportunity to create this third runway with an axial displacement and a threshold offset in such a way that will be able to operate in an independent manner.

![Fig. 5. Centerline separation Taxiway – Runway: 210 meters](image-url)
A third parallel runway has to be located at the north east of the current concrete runway 11/29 and it has to have a minimum center line separation between them of 2500 feet (762 m) or up to 4300 feet (1310 m) if the concept is to operate every runway as an independent one in terms of arrival/arrival, departure/Departure, arrival/departure and departure/arrival. Fig 6.

If we locate this third runway at the north, the problem that we observed is in relation to land ownership to be able to accommodate this future expansion.

The total land area of the airport is 881.65 hectares and with the expansion to a third runway (a second parallel runway) the area needed will be an additional 372 hectares for a total of 1,253.75 hectares.

If we look at the cartography we can observed that the terrain to the east is not perfectly plane, some intervention has to be done to expand the airport. At the same time, this land is privately own and has to be negotiated and/or pay fair compensation by the government if the powers of eminent domain are used. Fortunately no city or housing projects are around and none agricultural land would be affected.

At the same time, I will be planning for an offset of 900 meters on the third runway and reduce the centerline separations between runways from 762 meters to 582 meters. A reduction of 30 meters each 150 meters of offset, meaning a total reduction of 180 meters. Fig. 7.

Fig. 6. A third parallel runway as independent operations at 762 m.
Fig. 7. Final Design. Parallel runway at 582 m. centerline separation from R11/29. Axial displacement 900 m.

- Taxiway Circulation

Currently the runway 11/29 is used for both arrival and departures and has two taxiway bridges that connect this main runway to the taxiway and the apron taxiway. Fig. 8.
If a third runway is constructed in the future, the concept will be to have one runway for departures and the new runway for arrivals. The closer to the terminal buildings should be the departure one to avoid taxi distances as much as possible and to manage operations in a safer manner. There is a probability to anticipate congestion at the taxiway near the terminal and at the connecting ways (or bridges) towards the terminal B and C. Fig. 9.

![Fig. 9 Taxiway circulation with the new runway in place.](image)

There is a possibility to close the current runway 16/36 and convert it to a taxi lane between the two parallel runways. A new taxiway will be planned between the two runways and at the connections will be as shown in figure 9.

- Walking distances

As it was mentioned before, the Monterrey International Airport has 3 passenger terminals (A, B, and C) and one cargo terminal. In this section, the objective is to evaluate the maximum walking distances for a passenger to go from a check-in counter to the final gate and boarding.

**Terminal A** (fig. 10) has 9 contact stands and 12 remote. For a passenger that goes domestic or international in terminal A the distances are as follow:

<table>
<thead>
<tr>
<th>Gate/centroide</th>
<th>meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-A'(satellite):</td>
<td>186</td>
</tr>
<tr>
<td>A’-(gates A1-A15):</td>
<td>120</td>
</tr>
<tr>
<td>A’-(gates B3-B8):</td>
<td>110</td>
</tr>
</tbody>
</table>

Note: There are no walkways but electrical stairs in two points (before and after the subterranean tunnel)

**Maximum walking distance from A-contact stand:** 306 meters.  
For remote stands, passengers would be asked to walk up to 400 meters, experiencing a maximum walking distance of: 706 meters.
Monterrey airport does not count on people movers. Special shuttles should be provided to transport passengers from the terminal to the remote park.

Fig. 10. Terminal A

**Terminal B** (fig 11) has 6 contact stands and 7 remote positions, it was recently opened. For a passenger that goes domestic or international in terminal B the distances are as follow:

<table>
<thead>
<tr>
<th>Gate/centroide</th>
<th>meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>B (contact)</td>
<td>40</td>
</tr>
<tr>
<td>B (remote)</td>
<td>150</td>
</tr>
</tbody>
</table>

**Maximum walking distance from B remote stand:** 150 meters.

OMA has a long term plan for the airport which includes extending Terminal C in 2009, and joining Terminal A and Terminal B, and cancel the satellite building of terminal A by 2012.

Under this perspective to achieve proper connection between terminal A and B at least 700 meters of walkways or a bridge has to be constructed to fully integrate both terminals, and even if the walking distances are reduced for the passenger, I disagree with this model of eliminating the satellite building since some contact stands will be lost reducing capacity and efficiency.
Terminal C is used for low cost carriers such as Viva Aerobus and holds 8 remote positions. The maximum walking distance for a passenger will be 250 meters. 6 remotes positions are as close as 100 meters distance and two of them at 200 and 250 meters. Fig. 12.

The maximum walking speed of a human is between 4.5 and 4.75 kms/hour meaning 4,500 meters/hour or 75 meters/min.

The walking distances of 306 meters will be done in 4.08 minutes and for the contact positions the passenger will be asked to walk up to 706 meters meaning 9.41 minutes. As a conclusion on this topic, there are not walking distance problems in the case of Monterrey International Airport.
Cargo at Monterrey Airport

Monterrey International Airport offers cargo services into final Mexican destinations and as a logistic center. Monterrey has been an industrial city since 1900’s handling an important number of industrial operations in the State of Nuevo Leon. Monterrey is the third largest city in the country and has a close border with the United States; this creates an opportunity to develop the cargo facilities. In 1998, 14,627 tons were handled at this facility. There is no available published data for the years after the privatization process.

The cargo area has 6 hectares for cargo operations and offers a fiscal zone, warehouses, import and export areas, merchandise control and parking for 359 automobiles and 32 trailers.

Evaluating the cargo aspects in this particular airport, I anticipate some possible problems that can develop in the future:

1. The cargo area and the terminal C for passenger (Viva Aerobus) share the same space for aircraft parking.
2. There is not a direct relation on the cargo and passenger functions and this type of administration can damage the future efficiency of passenger operations.
3. Being “the passenger” the main business of the OMA group and being the current numbers 6,586,200 passenger for the year 2008 and the projections of 10 million passengers for the year 2011, there seem to be more important for the group to work on these immediate needs.
4. In Mexico, 77.48% of the cargo (tons.) is transported by highways, 15.5% use railroad and 7% is reported by cargo airplanes, being this last one a small amount of the cargo business in the country.
5. 65% of the cargo takes the route Monterrey-Laredo for export-import purposes. The Port of Laredo, Texas is the main port of Mexico regarding trade. This port is directly connected to the Federal Highway 85 that further connects to the I-35 in the United States. This Federal Highway is in direct contact to another airport in Monterrey, the Aeropuerto del Norte.
Regarding this last point, it has been discussed at a political level that the Aeropuerto del Norte, today a private airport for general aviation can be reconverted into a cargo facility and technological aeronautical park.

This airport of 239 hectares is located as well in Apodaca, counts on two runways the 11-29 of 1539 meters and the 02-20 of 2011, both in asphalt. It was created by American Airlines 60 years ago, the company was interested in creating a service of Monterrey when there was not an available airport. Today this airport has 200 active partners and 300 jets and planes. It has instrument landing system (ILS) and light infrastructure such as: P.A.P.I. (Runway 20), A.V.A.S.I. (Runway 02, Runway 11), R.E.I.L. (Runway 20), taxi lane: ECO and ALFA before the runway 11-29 and Taxi lanes have signaling with light reflectors. Fig 12.

Fig. 12. Aeropuerto del Norte. Federal Highway 85 (orange).

Conclusion

I can conclude that, after have studied and have proved the design aspects of Monterrey International Airport and according to the FAA and ICAO standards, the airport is well designed according to the category V/E and it can accommodate models as large as the B747-400 with a wing span of 64.4 meters.

The future cancellation of the runway 16/36 can be a good effect just after having in place the new parallel runway to 11/29.

The issue of land acquisition will be a situation because private owners understand the high value of the land for airport expansions. The privatization program will last 50 years and the concession has run for 10 years. OMA has a master plan to develop
according to the traffic growth figures and it is revised by the Mexican Federal Level. The capital improvements should be done before the concession finalizes its term.

The airport handles 300 flights per day and it operates 24 hours. On peak hours it is estimated that the 10% of the total movements will occur meaning: 30 movements/hour. With the future runway and the capital investments that are being made for the creation of the terminal buildings the airport will be in excellent conditions to face the future growth in the next years according to the 2012 plan.

Waking distances does not represent a situation to look closely since the passenger does not have to travel for more than 10 minutes. However, the future connection between terminal buildings A and B will become a design challenge to provide passenger efficiency and commodity. And the connection between terminal C and A will be as well a design action to be solved if the concept will be to direct passengers in the most efficient manner.

I do not think that cargo facilities should continue developing in this area since there is a land constrain, and even if industrial parks are located in a 2 kilometer radios, the motivation and type of client from cargo and from passenger operations are particularly different and it would be convenient to place more time and investment into the passenger side.

Bibliography