Planning for Capacity in the Context of Africa: A Case Study of Ethiopia, Kenya, and South Africa

1.231: Airport Systems Planning and Design

Term Project
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1. Introduction

Africa is a massive continent. It encompasses 11.6 million square miles, making it three times as large as the United States of America. The continent consists of 54 recognized countries, 15 of which are land-locked. These represent about 24% of the continent’s entire land mass. Due to decades of civil wars and poverty that have afflicted many African countries, many of the roads are in deplorable conditions and there is scant rail service within the continent. Hence, the massive size of the continent together with the almost non-existent surface transportation makes aviation the only realistic intra-continent mode of travel.

However, the aviation situation in Africa has not been hopeful during the past several decades – the performance of the industry has continued to lag behind those of the rest of the world. According to the World Bank, the continent contributes to less than 3.7% of the global air service despite having more than 12% of the world’s population [2]. The industry is characterized by the following negative factors: low safety and environmental standards; old aircraft fleet with an average age of 18 years (the continent will need 1,000 new aircraft within the next 15 years to replace old technology); need for autonomy in civil aviation authorities; need for infrastructure and personnel training; need for collaboration between airlines and open skies agreements [17].

Nonetheless, there is great promise in the improved performance of the aviation industry in Africa over the coming years. According to the African Development Bank (AfDB), demand for air transport in Africa has increased steadily over the past years with passenger numbers and freight traffic growing by 45% and 80%, respectively [4]. It is predicted that over the 2010-2015 period, Africa will the third fastest growing region in terms of international traffic. This positive trend is expected to continue in the coming years due to a number of factors: a notably robust economic growth (one third of the countries in the continent have GDP growth rates that are greater than 6%); demographic boom (the average annual growth rate for the continent is around 2.3%); the emergence of the middle class, which represents more and more people who can afford to pay for the cost of air travel (according to Bombardier, the sub-Saharan African region will see the middle-class consumer spending grow from $0.8 trillion to $2.0 trillion by 2030); and increasing urbanization [4], [10].

In southern and eastern Africa, air traffic is growing strongly around hubs in Johannesburg, Addis Ababa, and Nairobi, which together handle more than 36% of all international traffic in...
Africa [2]. In central and western Africa, however, the market has been stagnant and the vacuum created by civil wars and the demise of several regional airlines remains to be filled. Fig.1 below is a map of Sub-Saharan Africa’s top 60 international routes in 2009. It shows the regional disparities that are evident within the industry, and shows the concentration of traffic around the hubs in Johannesburg, Addis Ababa, and Nairobi.

This paper focuses on the three aviation hubs – Johannesburg, Addis Ababa, and Nairobi – and the capacity of the airports in these cities. It gives a hub-by-hub analysis of the current capacity and the planned expansion and development of these hub airports to meet expected demand in the continent.
2. Case Study of Jomo Kenyatta International Airport, Nairobi, Kenya

Kenya is an African nation that lies across the equator in eastern Africa, on the coast of the Indian Ocean. The country is approximately twice the size of the state of Nevada in the U.S., and borders Somalia to the east, Ethiopia to the north, Tanzania to the south, Uganda to the west, and Southern Sudan to the northwest. According to the Central Intelligence Agency (CIA), Kenya has a population growth rate of 2.27% (ranking it the 40th highest in the world), a GDP per capita of $1,800 (ranking it the 198th highest in the world in 2012), and a GDP real growth rate of 4.7% (ranking it the 70th highest in the world in 2012) [12]. Kenya is renowned for its great scenery, tremendous topographical diversity, and a rich diversity of wildlife. Furthermore Nairobi, Kenya’s capital, has gone on to become an African tech hub, attracting IBM’s first research lab in Africa, as well as fellow tech giants Intel, Nokia, Google, and Microsoft. Owing to these factors, tourism is the country’s second largest foreign exchange earner after agriculture. Air transportation, therefore, plays a vital role in the sustenance of the country’s economic growth. Most of the passenger traffic flies into and out of the country via the main airport, Jomo Kenyatta International Airport (JKIA) which is located in Nairobi, and some of the traffic goes through Moi International Airport which is located in the coastal town of Mombasa. Kenya has a flag carrier - Kenya Airways (IATA /ICAO code KQ). The airline has its hub at JKIA and was wholly owned by the government until 1995 when it was privatized in 1996, becoming the first African flag carrier to successfully do so.

2.1. History and Traffic Performance of Jomo Kenyatta International Airport, Nairobi, Kenya

The Jomo Kenyatta International Airport in Nairobi, Kenya, is the largest aviation facility in Kenya and the busiest airport in East Africa. The airport was opened in 1958 as Embakasi Airport (since it’s located in the Embakasi suburb 9 miles southeast of Nairobi’s central business district). Later, the airport was renamed after Jomo Kenyatta, Kenya’s first president and prime minister. The airport is currently managed by the Kenya Airports Authority (KAA) which is a parastatal organization.

JKIA serves as the hub for Kenya’s flag carrier, Kenya Airways, as well as for a low-cost carrier, Fly540, and serves over 30 scheduled airlines. The airport accounts for 75% of the national aviation traffic and is ranked as the 8th busiest airport in Africa with respect to passenger traffic, and the 3rd busiest in Africa with respect to cargo traffic [17]. When the airport first opened in
1958, it had been designed to handle a maximum capacity of 2.5 million passengers per year. However, by 2006, the airport was handling in excess of 4.4 million passengers – almost twice its maximum capacity [6].

Fig. 2 below illustrates the percentage of actual passenger movements at the airport over the years 2002-2011. The figure shows that the airport has been handling an increasing number of passenger movements and has been operating above capacity throughout the time period. According to the figure, passenger movements grew by 127.27%.

Fig. 3 below illustrates the percentage of actual aircraft movements at the airport over the years 2002-2011. The figure shows that the airport has been handling an increasing number of aircraft movements and that although the actual number of aircraft movements handled has remained below the designed maximum capacity, the total movements per year are approaching the maximum capacity of the airport. According to the figure, aircraft movements increased by 110% during the time period.

Fig. 2. Passenger Movements at JKIA. Source: Kenya Airports Authority
2.2. Traffic Outlook at JKIA

Airline passenger traffic is predicted to continue growing within Africa as a whole, and Kenya is no exception to this. In relation, traffic at JKIA is expected to continue growing through 2030. Below are the forecasts in passenger traffic at the airport according to the master plan developed for the airport:

<table>
<thead>
<tr>
<th>Year</th>
<th>International</th>
<th>Domestic</th>
<th>Total</th>
<th>Transit</th>
<th>Grand Total</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3,423,894</td>
<td>958,925</td>
<td>4,382,819</td>
<td>1,097,369</td>
<td>5,480,188</td>
<td>9.90%</td>
</tr>
<tr>
<td>2011</td>
<td>4,081,692</td>
<td>1,185,372</td>
<td>5,267,064</td>
<td>1,581,971</td>
<td>6,849,035</td>
<td>24.98%</td>
</tr>
<tr>
<td>2012</td>
<td>4,842,388</td>
<td>1,235,900</td>
<td>6,078,288</td>
<td>2,169,330</td>
<td>8,247,618</td>
<td>20.42%</td>
</tr>
<tr>
<td>2013</td>
<td>5,217,663</td>
<td>1,335,920</td>
<td>6,553,583</td>
<td>2,361,268</td>
<td>8,914,851</td>
<td>8.09%</td>
</tr>
<tr>
<td>2014</td>
<td>5,564,634</td>
<td>1,428,431</td>
<td>6,993,065</td>
<td>2,525,562</td>
<td>9,518,627</td>
<td>6.77%</td>
</tr>
<tr>
<td>2015</td>
<td>6,032,492</td>
<td>1,594,671</td>
<td>7,627,163</td>
<td>2,892,672</td>
<td>10,519,835</td>
<td>10.52%</td>
</tr>
<tr>
<td>2020</td>
<td>9,344,692</td>
<td>2,449,863</td>
<td>11,794,555</td>
<td>4,812,199</td>
<td>16,606,754</td>
<td>8.80%</td>
</tr>
<tr>
<td>2025</td>
<td>13,354,159</td>
<td>3,543,912</td>
<td>16,898,071</td>
<td>7,348,334</td>
<td>24,246,405</td>
<td>8.20%</td>
</tr>
<tr>
<td>2030</td>
<td>18,587,399</td>
<td>4,979,394</td>
<td>23,566,793</td>
<td>10,740,716</td>
<td>34,307,509</td>
<td>7.60%</td>
</tr>
</tbody>
</table>

Table 1. Forecasted passenger movements at JKIA. Data source: Kenya Airports Authority
According to the forecast, by 2030, JKIA will be handling an annual passenger traffic that exceeds its current maximum capacity by about 31.8 million passengers per year (an increase of 1272%). Furthermore, with the airport’s runway capacity of 120,000 movements per annum, it is operating at 83% capacity – a major contributor of unstable operational conditions at the airport due to operating close to capacity [1]. These factors imply that JKIA is in dire need of the upgrading and expansion of its terminal as well as its airside facilities.

The expansion and modernization of JKIA is one of the initiatives proposed by the Kenya Vision 2030. The Kenya Vision 2030 is the country’s development program that is aimed at transforming the country into a “newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment” [20]. The plan was launched on 10th June, 2008 by the country’s former president, Mwai Kibaki.
2.3. Facilities at JKIA

Currently, JKIA operates using one asphalt runway that is 4,117 meters (13,507ft) long, 45 meters (148ft) wide, and is oriented 06/24 [17]. The airport’s original airport which was built in 1972 with funds from the World Bank is located on the northern side of the runway and is used for military purposes by the Kenya Air Force. It is sometimes referred to as Old Embakasi Airport.

The current terminal building has a semi-circular pier configuration and has a capacity of 58,000m². It is divided into three parts: Units 1 and 2 which are used for international arrivals and departures, and Unit 3 which is used for domestic arrivals and departures. The current design of the terminal design does not allow for easy expansion.

Fig. 6. Overview Picture of JKIA
2.4. Expansion Program at JKIA

The first phase of the expansion and modernization project at the airport involves 8 packages as shown in Table 2

<table>
<thead>
<tr>
<th>PROJECT NAME</th>
<th>PROJECT DESCRIPTION AND ACTIVITIES</th>
<th>IMPLEMENTATION PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 JKIA Package 1</td>
<td>Construction of Parking Apron – works completed and are in use</td>
<td>Completed in 2008</td>
</tr>
<tr>
<td>2 JKIA Package 2</td>
<td>Construction of terminal unit 4 building, Multi-story car park and grade parking – Project currently underway as part of emergency recovery measures undertaken following the fire accident on 7th, August 2013.</td>
<td>September 2010-October 2012</td>
</tr>
<tr>
<td>3 JKIA Package 3</td>
<td>Renovation and re-organization of terminal unit 1,2,3 and arrivals building</td>
<td>2011-2015</td>
</tr>
<tr>
<td>4 JKIA Package 4-a</td>
<td>Rehabilitation and upgrading of</td>
<td>Jan 2012-June 2014</td>
</tr>
</tbody>
</table>
2.4.1. Implementation of the JKIA Expansion and Modernization Projects

i. Package 1: Parking apron was completed in May 2008, at a total cost of $40 million.
   - Outputs:
     - Increased apron space which was constrained at 200,000 sq. meters and catering for 23 stands, to 370,000 sq. meters to cater for 37 stands (an increase in aircraft parking space by 85%).

ii. Package 2: Total cost of this project was estimated to be $93.89 million.
   - Outputs:
     - Construction of a new Unit 4 which will cover a floor area of 26,000sq. meters (Expected to be completed by December 2014). The new terminal will significantly improve operational efficiency and increase comfort, safety, and security through the physical separation of arriving and departing passengers in keeping with the international standards. The project will include: design, supply and construction of the terminal building; installation of a departure and arrival Baggage Handling System.
Njuguna, Esther

(BHS); installation of airport special systems; inter-phasing of utilities to existing supply; and, testing and commissioning of the terminal building. This part of the project is envisaged to cost $28 million.

- Construction of a multi-story car park with a capacity of 1,500 vehicles (Expected to be completed by March 2014).
- Expansion of grade parking by 10,000sq. meters to provide an additional 400 parking spaces and associated facilities.

iii. Package 3: It involves building an additional floor to the existing terminal and refurbishment and reorganization of the terminal. The total cost of this is estimated at $78 million.
   - Outputs:
     - This package would increase the floor area by 26,600sq. meters.

iv. Package 4-a: This will involve pavement rehabilitation and upgrade of ILS and runway capacity, at a total cost of $48 million.
   - Outputs:
     - ILS Upgrade from CAT I to CAT II.
     - Extension of aircraft pavements’ life-span by milling and resurfacing.
     - Runway capacity upgrade with new rapid-exit taxiways which will allow for more arrivals.

v. Package 4-b: The construction of remote stands is estimated to cost $29 million.
   - Outputs:
     - 16 Category C B737 stands complete with fuel hydrants.
     - Increase in apron capacity

vi. Package 7: Construction of a new Green Field terminal is estimated to cost $500 million.
   - Outputs:
     - An increase in passenger capacity by 20 million passengers per annum and an additional floor area of 172,000 sq. meters.
     - Increased efficiency in connectivity for transiting passengers with: 50 international and 10 domestic check points; 32 contact and 8 remote gates; associated apron with 45 stands and linking taxiways; a railway terminal.

vii. Package 8: Construction of a new runway is estimated to cost $150 million.
   - Outputs:
▪ New runway will fulfill ICAO code F standards and have a length of 4,000 m.
▪ ILS equipment, Doppler VHF Omni Directional Radio Range (DVOR), Radar, Localizer, Glidepath
▪ Airfield lighting system
▪ Associated facilities

The entire cost of expanding and modernizing JKIA is estimated to be between $650 million - $940 million – what some may call an “ambitious plan for a developing nation”, but a much needed intervention from aviation.

Below are images of the planned and ongoing projects in the expansion and modernization of the airport.

Fig. 8. Plan Overview of the JKIA expansion completion
Fig. 9. Completed Terminal building with international pier

Fig. 10. International Pier (Terminal 4)

Fig. 11. Planned Airport Entrance

Fig. 12. Planned Airport Interior
3. Case Study of Bole International Airport, Addis Ababa, Ethiopia

Ethiopia is an African nation located in what is referred to as the Horn of Africa (the easternmost projection of the continent), bordering Eritrea to the north, Djibouti and Somalia to the east, Sudan and South Sudan to the west, and Kenya to the south. The country is home to over 93,000,000 people, making it the most populous landlocked country in the world and the second most-populous nation in Africa. According to the Central Intelligence Agency (CIA), Ethiopia has a population growth rate of 2.9% (ranking it the 12th highest in the world), a GDP per capita of $1,200 (ranking it the 211th highest in the world in 2012), and a GDP real growth rate of 7% (ranking it the 28th highest in the world in 2012) [13]. Out of Ethiopia hails one of the biggest success stories in aviation in Africa – Ethiopian Airlines. Ethiopian Airlines (IATA/ICAO Code ETH) is the flag carrier of Ethiopia, and one of the largest and most profitable carriers in Africa (the airline boasts a record of 12 consecutive years of profit). It was founded in 1945 and is wholly owned by the Government of Ethiopia. The airline commands a lion’s share of the Pan-African network and currently serves 78 international destinations, operating the newest and youngest fleets [10]. Ethiopian Airline’s vision is to become the leading aviation group in Africa by the year 2025. The airline has its hub in Bole International Airport, located in Addis Ababa, Ethiopia’s capital.

3.1. History and Traffic Performance of Bole International Airport

Addis Ababa Bole International Airport (referred to here as Bole International Airport) is Ethiopia’s busiest airport and one of the busiest airports in Africa. It is operated by the Ethiopian Airports Enterprise, a publicly owned organization. Bole International Airport was opened in 1950 as Haile Selassie I International ADD Airport. The airport is located in the Bole area which is 8km southeast of Addis Ababa.

Bole International Airport has two terminals – Terminal 1 which is dedicated to domestic operations, and Terminal 2 which is dedicated to international operations. Terminal 1 was renovated and expanded and now has 4 airline gates. Terminal 2 is fairly new and was opened in 2003. It is a modern steel-and-glass building with 7 airline gates. It has three levels, with its own parking garage, shopping complex, restaurants, and other amenities.

The airport currently has two close-parallel asphalt runways, one of which is fairly new and was completed in 2003. One runway is oriented 07R/25L and is 4,725m (15,502ft) long and the other is oriented 07L/25R and is 4,604m (15,301ft) long.
When the airport was initially built, it was intended to have a mere capacity of 500,000 passengers per year. Hence, in the early 1980s, a major expansion project for Bole International Airport was planned, to increase the capacity 12-fold to 6-7 million passengers a year. The project was drafted in the early 1990s and it was assumed that with the maximum capacity of 6-7 million passengers per year, the airport would accommodate air traffic until 2017 and that there would be more than enough time to plan for any future developments should they be necessary. However, like in many other projects, the forecasting was wrong [1] – by 2010, the airport had already almost reached its planned maximum capacity.

Fig. 13 below shows the total passenger movements at Bole over the 2000-2012 time period, compared to the maximum capacity at the airport. The airport was operating above capacity until 2003, when the new runway and terminal were built to increase capacity 12-fold. As is illustrated in the figure, the airport is back to operating above its maximum capacity.

![Fig. 13. Passenger Movements at Bole International Airport. Source: CAPA](image)

### 3.2. Expansion Project at Bole International Airport

In December 2010, the Ethiopian Airports Enterprise announced another expansion project at the airport [5]. The project consists of the following major expansion plans:

1. Construction of a new taxiway at the airport in order to enhance the capacity to meet the increasing air traffic flow. This first phase of the project has been completed at a total cost of $62 million. This has permitted the airport to be able to handle 34 aircraft simultaneously (up from 19 aircraft previously) with the second phase already underway to further increase that capacity to 44 aircraft.
II. To expand the existing passenger-handling capacity at the airport by constructing a new extension that will connect the international terminal (Terminal 2) with the domestic terminal (Terminal 1) rather than have the two separate as is the case.

III. Construction of a new state-of-the-art cargo terminal that is set to handle 1.2million tons of cargo per annum.

Furthermore, there are plans to build an entirely new international airport on the western outskirts of Addis Ababa in the Oromia Special zone (a region set aside for inhabitation by the Oromo people of Ethiopia) [15]. After the construction of the new airport, Bole International Airport will be used for regional and domestic flights, VIP flights, and other general aviation services, and the new airport will primarily accommodate long-haul international flights [15].

Below are current images of Bole International Airport:

![Fig. 14. Front view of Bole](image1)

![Fig. 15. Inside the new terminal at Bole](image2)

![Fig. 16. Overview Image of the close-parallel Runways at Bole](image3)
4. Case Study of OR Tambo International Airport, Johannesburg, South Africa

South Africa is an African nation located at the southern tip of the continent, neighboring Namibia, Botswana, and Zimbabwe to the north, Mozambique and Swaziland to the east, and surrounding Lesotho. It is the 25th largest and the 27th most populous country in the world. Interestingly, South Africa has a negative population growth rate of -0.45%, unlike most other countries in Africa which have positive population growth rates. The country has a GDP real growth rate of 2.5% (ranking it the 125th highest in the world), and is the richest nation in Africa with a GDP per capita of $11,600 (ranking it the 109th highest in the world in 2012) [14]. South Africa is a very popular tourist destination, with about 860,000 aircraft arrivals per month [8]. This in addition to the country’s vibrant economy, have promoted a successful aviation industry in the country.

South African Airways (ICAO Code SAA) is the national flag carrier of South Africa, as well as the largest airline in the nation. It was formed in 1934 and is fully owned by the South African government. The airline has its hub in OR Tambo International Airport.

4.1. History of OR Tambo International Airport

OR Tambo International Airport (referred to here as OR Tambo) is situated in Gauteng, South Africa, near the city of Johannesburg, and is operated by Airports Company South Africa (ACSA), a partially privatized company. The airport was founded in 1952 as the Jan Smuts Airport, was renamed to Johannesburg International Airport in 1994, and again renamed in November, 2006 after Oliver Tambo, a famous anti-apartheid politician. OR Tambo is South Africa’s main airport, handling more than 50% of the nation’s air passenger traffic. Furthermore, the airport is the biggest and busiest in the continent, servicing airlines from five continents.

4.2. Facilities at OR Tambo International Airport

OR Tambo has 6 terminals that are broken down into three major areas: Terminal A which is used for all international operations, Terminal B which is used for domestic operations, and a Central Terminal Building (CTB) which is used as a transit between the other two terminals (it serves as a bridge between the international and domestic terminals). The Terminal A building has 3 levels. The ground level is used for all international arrival operations; the first level is used for all international departures; the mezzanine level is used for both international departure and arrival operations.
The Terminal B building has 4 levels. The ground level is used for domestic arrival operations; the first level has retail outlets that are accessible to both arriving and departing passengers; the second level is used for domestic check-ins and domestic departures; the third level has several offices and lounges.

The airport has two parallel runways which run north-south, and a disused cross runway. The western runway is oriented 03L/21R and has a length of 4,418m. The eastern runway is oriented 03R/21L and is 3,400m. The western runway is one of the world’s longest international airport runways. This is attributed to the rarefied atmosphere problem in which full laden aircraft require a far greater length of runway to achieve take-off velocity than they normally would have. OR Tambo is regarded as a “hot and high” airport – it is situated at almost 1,700m (5,500ft) above mean sea level and the air is thin. This results in decreased performance in aircraft departing from the airport [7].

4.3. Capacity and Traffic Performance at OR Tambo International Airport

OR Tambo currently has the capacity to handle 28 million passengers per annum [8]. This is an increased capacity which is as a result of expansion projects in 2008 which were aimed at handling the influx of passengers expected during the 2010 FIFA World Cup held in South Africa.

Fig. 16 and Fig. 17 below illustrate the passenger and aircraft movements at OR Tambo reported for each fiscal year from 2007-2014.

![Passenger Movements at OR Tambo](image)

Fig. 17. Passenger Movements at OR Tambo. ACSA
The Year-to-Date trends in both passenger and aircraft movements illustrate that the total number of passengers and aircraft handled at OR Tambo has remained fairly constant over the years. Of note, the airport did not have a peak in operations during the 2010 World Cup as was expected.

### 4.4. Expansion of OR Tambo International Airport

OR Tambo has undergone numerous developments and improvements over the years to increase its capacity and to maintain it as one of the best and most comfortable airports in South Africa. The most significant of these projects was commissioned in 2008, in the prospect of the 2010 FIFA World Cup. The project involved the following key expansion components:

- Construction of a new central passenger terminal building
- Reconfiguration and upgrade of the existing international terminal building
- Construction of additional structural car parking
- Additional fuel tanks
- Widening of runway and taxiway shoulders in order to accommodate the Airbus A380

The total cost of the expansion was estimated to be R5.2 billion ($497 million). The first phase of the construction of the central terminal building was opened in September, 2008. The 18,000-sq-meter facility includes retail stores, a post office and foreign currency exchanges. The final phase of the terminal was completed in April 2009, and the facility was officially inaugurated in April 2010. It had cost $220 million to complete the terminal.
Currently, OR Tambo has a parking capacity of 17,500. In 2007, the capacity of the low cost long-term parking bay was increased by 300 spaces to bring its total capacity to 2,400. The multi-story parking extension was completed in March 2009 at a cost of $48 million. This increased the capacity of the parking lot to 5,300 spaces. Furthermore, bay detection technology was installed for passengers to conveniently provide parking information.

Fig. 19 below is a diagram of the development plan at OR Tambo.

![Johannesburg International Airport - Development Plan](image1)

Fig. 19. Major Projects at OR Tambo

![Johannesburg Tambo International Airport - JNB](image2)

Fig. 20. Domestic and International Terminals at OR Tambo

Fig. 21. Overview Image of Parallel Runways at OR Tambo
4.4.1. The Aerotropolis East Initiative

Early this year, the Airports Company South Africa (ACSA) was said to be close to signing a partnership deal with development companies to expand OR Tambo through the commercial development of airport land that was previously owned by an arms manufacturer. The proposed development is based on a study previously conducted by a Netherlands company in 2005. This long-term strategic plan takes its cue from current urban design thinking around a new kind of urban form – the aerotropolis, or airport city [9]. Netherlands Airport Consultants (NACO) proposed a development of the midfield area by constructing an X-shaped satellite between the two current runways, as well as a possible construction of a third and fourth runway, as shown on Fig.22 below.

Fig. 22. Proposed X-Shaped Terminal
Areas of interest to developers and investors would be:
• 1. Commercial facility – Ex-International Trade Bureau (ITB)
  Location: Passenger terminal precinct
  Size: 2 262m building
  General: Possible uses include tourism, a business centre, a conference facility, offices, exhibitions, events and retail.
• 2. Precinct 3 Logistics
  Location: North east via R21 Atlas road interchange, Safcor Panalpina and Siemens logistics facilities nearby
  Size: Minimum 20 000m land or larger, subject to conditions
  General: Logistics uses.
• 3. Land lease area
  Location: South, access from Springbok Road
  Size: 18 000m land
  General: Future road access to new Midfield terminal; temporary use for about three years.
• 4. Aerotropolis East – Ex-Denel precinct
  Location: East, access from Atlas Road via N12 or R21 freeway
  Size: Subject to final planning and land uses
  General: Aviation related component, mixed use envisaged.
• Proposed new offices
  Location: Above multi-storey parkade 2
  Size: Site area 7 000m2
  General: General lettable area is 10 000m2.

Fig. 23. The Proposed Aerotropolis, Aerotropolis East
5. Conclusion

With the inquest of expansion and development projects at airports all over the continent, a claim has been made that there does not exist a justification for this. According to a study done by the World Bank, infrastructure is not the heart of the sector’s problems – the total number of airports is stable and there are enough runways to handle traffic in the near future with better scheduling and relatively modest investment in parallel taxiways and terminal facilities [2]. Overall, though, as would be expected, the higher the volume there is at an airport, the better the quality of airside infrastructure. In major hubs such as Johannesburg, Egypt, Morocco, and Nairobi, the overall airside installations are fairly standard in terms of runway length, instrument landing systems (ILSs), etc. However, as soon as the volume at an airport drops, significant differences in the quality of the infrastructure become apparent.

Although the overall volume of traffic flying into airports without paved runways is relatively small, the number of airports with poor runway conditions is fairly high in some African countries. The implication is that, looking at traffic per airport, there is no current need of new airports in Africa, but rather the need to optimize existing facilities. Capacity constraints on airports, however, can and do show up on taxiways, aprons, and jet ways. Runway capacity, for example, depends heavily on how quickly an aircraft can leave or enter the runway. Many African airports deploy a low-cost design in which instead of the aircraft leaving the runway via a turnoff after landing, the aircraft must taxi to the turning bay, turn around, and taxi toward the access to the apron usually found in the center of the runway. This is acceptable in an airport where there is enough time between departing and arriving aircraft to do so, but high-volume airports require parallel taxiways with multiple turnoff ramps from the runway [2]. In addition, if parking space on the apron is limited, an airport can quickly come to a standstill.

Hence, although expansion is warranted in some African airports, the focus of improving the industry in the continent should be on increasing the efficiency by:

- allowing more participation from the private sector (both in airlines and airports
- improvement and installation of air traffic control surveillance and communications systems, and weather dissemination systems
- implementation of a proper legal framework and oversight
- improvement of safety and environmental standards
- continued liberalization
implementation of a proper data collection system in order to better understand the industry

The implementation of the above would ensure that Africa’s aviation industry is in a position to create market opportunities for local entrepreneurs by creating regional and global economic centers.
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