



ICAO

UN HABITAT
FOR A BETTER URBAN FUTURE

PROMOTING SYNERGY BETWEEN CITIES AND AIRPORTS FOR SUSTAINABLE DEVELOPMENT

Report by:

The International Civil Aviation Organization
(ICAO)

And

United Nations Human Settlements Programme
(UN-Habitat)

July 2018

FOREWORD (ICAO Secretary General)

Serving as a global forum for its 192 Member States, ICAO has developed Standards and Recommended Practices (SARPs) for sustainable development through airport planning and the protection of the environment, and Procedures for Air Navigation Services (PANS) that allow member States to implement a seamless global aviation system.

Air transport is a crucial segment of a multimodal transport system and contributes to economic and social activities such as tourism, trade, business, urban forms and settlement patterns. The international community understands that safe, rapid, reliable and environmentally-friendly global connectivity is essential to realizing the ambitious and visionary Agenda 2030.

Airports have evolved from simple grass and gravel airfields to airport cities (Aerotropolis), with large scale airport infrastructure to handle aircraft movement, passenger and cargo traffic. Modern airports have complex land use structures to support aviation activities and services, and other associated needs. Air traffic projections indicate that worldwide aircraft movement flight and passenger volumes are projected to double by 2030, thus it is critical that States invest in infrastructure development to support the anticipated global growing demand for connectivity and mobility.

ICAO has mapped its current Strategic Objectives for global civil aviation against 15 of the 17 Sustainable Development Goals, outlined in the 2030 Agenda. The total economic impact of aviation will reach 3.5 per cent of GDP, or 2.4 trillion US dollars, and the employment of 58.1 million people, due to its cross-cutting nature and multiple links to other economic sectors. This authenticates that aviation generates sustainable prosperity and transforms lives.

The UN 2030 Agenda outlines for a global partnership that will bring together Governments, the private sector, society, the UN system, and other sectors to mobilize all available resources for its implementation. Accordingly, ICAO and UN-Habitat initiated a partnership with a view to collaborate on matters of common interest and to harness the existing synergies.

By 2050, the world urban population is expected to nearly double, making urbanization one of the 21st century's most transformative trends. Even though the concentration of population, economic activities, social, and cultural interactions in cities has most likely a potential positive implication on the growth and development of air transport, it might also equally cause major sustainability challenges unless they are appropriately addressed in a coordinated and effective management system. It is with this understanding that ICAO and UN-Habitat prompted a focused collaborative framework to foster joint activities with a purpose to creating synergy between sustainable airport and urban development.

Realizing the need for enhanced synergy between airports and urban development, five airports in four cities (Addis Ababa, Nairobi, Ekurhuleni and Johannesburg) were selected in the Eastern and Southern Africa Region for the implementation of a pilot project. The outcome of the project would be to provide additional information, to complement and possibly enhance existing ICAO documents to enable further synergies between sustainable airports and urban development.



Secretary General
International Civil Aviation Organization

FOREWORD (UN-Habitat Executive Director)

The human society is based on perpetual associations, making mobility a crucial factor for human activities and settlement patterns over the course of history. Road, rail, maritime and air transport have provided modes of travel that facilitate mobility of persons, goods and services. Air transport is now offering increased connectivity for even distant and inaccessible regions. This connectivity has a large impact on economic growth and urban development of the regions. Being connected to the (global) markets increases business opportunities in trade, tourism and fosters social interactions of people - worldwide.

For over 40 years, UN-Habitat has been working on projects across the world improving human settlements - in order to achieve socially, economically and environmentally sustainable development. Today, managing urbanization is a pressing need, as it is estimated that by 2050, nearly two thirds of the global population will be urban. Over the course of aviation history, airports have evolved from simple grassy and gravel airfields to elaborate airport cities (Aerotropolis); with large-scale aviation infrastructure to handle human traffic, cargo and requisite attendant aviation services.

The proximity of airports to cities has led to the creation of development corridors between the airport facilities and core cities. Considering that airports have a crucial impact on a region's social, economic and ecological aspects, studying the role of airports as drivers for development will be decisive for future urban, metropolitan and regional planning. How to locate, design, manage and maintain airports in relation to core cities through engaging with the public sector, the people and private companies should be studied and demonstrated for wider dissemination.

The New Urban Agenda, a framework adopted by member states in 2016 at Habitat III, layouts out how cities should be planned and managed to best promote sustainable urbanization for the 20 years to come. It vouches for a new urban development model that integrates sustainability for all human settlements, no matter their scale. The four cities chosen for this pilot project, Ekurhuleni, Johannesburg, Nairobi and Addis Ababa are among the cities with the highest air passenger numbers in Sub-Saharan Africa. Also, the main metropolitan areas of these communities are undergoing remarkable urban growth. Understanding the relationship between airport and urban development, and focusing on synergies that will lead to improved long and medium-term planning, will support socio-economic growth in the selected cities and regions and the protection of the environment, and eventually give everyone a better quality of life.

ICAO and UN-Habitat are jointly examining, identifying and actively promoting the synergies between the airports and urban development in the four cities and beyond, which will contribute to synergistic development of airports and cities, and subsequent overall sustainable development as envisioned in the [2030 Agenda for Sustainable Development](#).



***Executive Director
UN-Habitat***

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EXECUTIVE SUMMARY

The United Nations (UN) 2030 Agenda outlines for a global partnership that will bring together Governments, the private sector, society, the UN system and other sectors to mobilize all available resources for its implementation. Accordingly, ICAO and UN-Habitat initiated a partnership with a goal to collaborate on matters of common interest incorporating the existing synergies.

Urban development is a structural and transformative change agent globally. By committing to make cities and human settlements inclusive, safe, resilient, and sustainable in the Post-2015 agenda, member States of the United Nations marked a net difference from and transition with the Millennium Development Goals (MDG); where environmentally-friendly urbanization is recognized as one of the key levers of positive socio-economic change.

The concentration of population, economic activities, social and cultural interactions in metropolitan areas has a potential positive implication on the growth and development of air transports and cities. It might also equally cause major sustainability challenges particularly in relation to the impact on the environment, unless they are adequately addressed in a coordinated, coherent and effective management system.

It is with this understanding that ICAO and UN-Habitat have focused on a collaborative framework with the goal to create synergies between sustainable airports and urban development.

The human society is based on perpetual associations, making mobility a crucial factor that has influenced human activities and settlement patterns over the course of history. Transportation has thus been a major determinant on how human societies have accessed and exploited resources to earn a livelihood. Air transport is thus crucial as it impacts social, economic and environmental activities.

Air transport is the only mode of transportation that facilitates fast mobility of people, goods and services. Air transport has also offered faster means of connectivity to remote and inaccessible regions, hence contributing to effective cooperation among cities. It has thus influenced human settlements and associated economic activities in different areas around the world.

Aviation has continued to spur socio-economic growth and development of States while limiting or reducing its impact on the environment, including in urban areas. This has contributed to improved business, trade, tourism and social interactions of people globally. Air travel forms a crucial aspect of the urban space. It is estimated that by 2050, more than half of the global population will be urban, generating more travel demand and increased airport facilities.

Therefore, there is a correlation in terms of economic performance between the growth of urban settlements and the projection by ICAO that worldwide aircraft movements and passenger volumes will double by 2030. As a result, there is a critical need for States to invest in infrastructure development to support the anticipated global growing demand for connectivity and mobility. It is also important to ensure that any growth meet the needs of the social, economic and environmental pillars of sustainability.

The New Urban Agenda requires a new urban development model that integrates all aspects of sustainability in all levels of human settlements for sustainable growth. In addition, it is recognized that attention should be given to the African Union (AU) Agenda 2063 which includes urban and air transport development in Africa. In regards to air transport, a single African air transport market towards the full implementation of the Yamoussoukro Decision on the liberalization of air transport markets in Africa and its roadmap have been approved by the AU Assembly of Heads of State and Government.

South Africa, Kenya and Ethiopia have high air passenger volumes in Eastern and Southern Africa and their metropolitan areas are undergoing remarkable urban growth; as well as a rising demand for

airport facilities. Studying the role of airports in the development cycle will be critical in ascertaining the relationship between airport and urban development; and how resultant synergies can be harnessed for environmentally sustainable socio-economic growth of cities and countries globally. This will be a crucial contribution to sustainability as required in the Sustainable Development Agenda.

In this context, the airports in the cities of Addis Ababa (Ethiopia), Nairobi (Kenya), Ekurhuleni and Johannesburg (South Africa) were selected for the implementation of a pilot project.

Best practices and principles in sustainable urban land use and land management around air transport infrastructure are of major importance in both airport and urban development. The current trends, which affect sustainability in development and land use management in and around airport facilities, are leading towards the construction of airport cities (Aerotropolis) worldwide. This report is based on the analysis of urban policies, plans and strategies of the selected cities taking into account inter-alia ICAO Standards and Recommended Practices (SARPS).

ICAO has developed important documents to guide the global aviation community: Airport Planning Manual Part 2, Land Use and Environmental Management (Doc 9184), ICAO Circular 351-Community Engagement for Aviation Environmental Management, the Guidance on the Balanced Approach to Airport Noise Management (Doc 9829), Airport Services Manual, Part 3 – Wildlife Control and Reduction (Doc 9137), Airport Air Quality Manual (Doc 9889), Report on Environmental Management System Practices in the Aviation Sector (Doc 9968), Operational Opportunities to Reduce Fuel Burn and Emissions (Doc 10013), and Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes (Doc 10031). This report also includes data collected from the four cities in addition to inputs received from stakeholders such as IATA, AFCAC, ACI, Airbus, Boeing, AFRAA, AU Commission, ACSA and RECs. UN-Habitat analysed trends in land uses in and around the airport facilities to determine changes over time. This evolution will need to take into account the ICAO SARPs and guidance to ensure it be done in alignment with its Strategic Objectives.

As stated in the Airport Planning Manual Part 2, the compatibility of an airport with its environs is an ideal that can be achieved by proper planning of the airport, management of pollution-generating sources, and land-use planning of the area surrounding the airport. The aim is to provide the best possible conditions for the needs of the airport, the community in the surrounding area and the ecology of the environment.

Land use changes along the transport corridors between the city and the airport over time is documented by local Authorities. Correlation of impact of air traffic growth in land use patterns of the airport vicinity and the related socio-economic and environmental impacts along the airport-core city axis should be taken into account. The development of the airport facilities and human settlement should not be detrimental to expansion.

The four cities have a cooperation framework between the airport and the municipality, however, the level of cooperation differs from one city to another. In addition to land use and development of non-aeronautical revenue, factors related to public or private services such as energy, water, sewage, ICT, drainage and waste management were considered. It is for this reason, that land-use and environmental management be integral in the planning process to ensure sustainability between the airport and surrounding community. This process should not be isolated to just the airport and local community, but also be conducted on a regional level.

This report also reflects in general terms the coordination of activities concerning facilitation, safety and security, airport emergency procedures and response, and the management of air navigation facilities installed in the local area and flight safety in the local airspace.

Through its Committee on Aviation Environmental Protection (CAEP), ICAO has developed important guidance material to balance the needs of the airport environs and operations, with the

needs of the local and regional communities. As global sustainable issues have evolved over time, it has been recognized that there must be complementary growth between all parties. Guidance and recommended practices provided by ICAO includes airport planning for land-use, environmental management, noise management, local air quality, global climate change and adaptation, and the need for community engagement.

ICAO develops Standards and Recommended Practices on a global level, which can be adopted on a local or regional level by member States. This approach complements UN-Habitat's objectives of well-planned, well-governed, and efficient cities and other human settlements. This is reflected in the following study.

The cooperation framework between the airport and the municipality is exemplified by the following examples of African airports. Each airport is unique in its operational requirements and facilitation needs between the airport and local community. Common challenges include: transportations master planning to ensure the access of passengers and goods and services between the airport and community; the robust management of the airside and landside airport operations; the cooperation between the airport and various levels of governments; sustainable development encompassing social, economic and environmental pillars, and air navigation. These challenges need to be addressed to ensure an effective Aerotropolis, focussing on the synergies between the airports and cities.

In Addis Ababa, the synergy between airport and city is performed through consultations on a case-by-case basis. Facilitation of passengers and goods at the airport is executed in accordance with ICAO SARPs. While the local transport system is stable, approximately eighty-five per cent of airport users are commuting to the airport by public transport. However, the public transport is not well coordinated in terms of interconnectivity and part of it is not time based (no timetable). It should be noted that the city already has adequate signage in all main roads guiding the public toward the airport and there is a plan to increase the number of signage in secondary roads. There is also a plan to extend the train service to the airport.

The airport master plan specific to the landside at the airport indicates that developments will be completed in the near future. Aerotropolis could be developed by 2030 following the construction of the mega hub international airport located out of the city to accommodate the predicted significant growth of passenger and cargo traffic. ICAO will be consulted and its guidance documents complied with, throughout the development process of the new site of relocation of the airport. It is also anticipated that non-aeronautical revenue will be maximized at the completion of the ongoing expansion of the passenger terminal and other developments in the landside.

The Air Navigation Service facilities of the airport are located in the local area owned or leased by the ECAA, and the responsibility of site protection is shared with the metropolitan authorities. Sites are in the mapping system of the city and public and private services are easily provided to the airport under reasonable terms and conditions.

The development of a regulation governing operations of a Remotely Piloted Aircraft Systems (RPAS) in Ethiopia is under process. The improvement in developing and managing urban infrastructure and facilities will increase urban mobility and enhance aviation capacity to contribute to non-aeronautical revenue and urban economy.

In Nairobi, the synergy between the airport and Nairobi City County is formalized through statutory meetings between the two parties. This cooperation has been enhanced due to the ongoing review of the Nairobi City Integrated Master Plan. It is expected that the review will result in, among other issues, the protection of both Nairobi airports (Jomo Kenyatta International and Wilson Airports).

Wilson Airport has reached the limit of expansion both on the airside and landside. The existing effective collaboration between KCAA, KAA and City has positively resulted in compliance with ICAO requirements for construction of metropolitan infrastructure devoid of obstacles to aviation in

terms of safety and security. The airport master plan at the Jomo Kenyatta International Airport includes the development of Sky City.

Considering that urban mobility affects the facilitation of air passengers, cargo and mail deliveries, as well as meeters and greeters, the current trend, where eighty per cent of airport users connect to airport by public transport, is deemed inadequate. However, plans are underway to develop the multimodal connectivity leading towards the airports. For example, the signage around the city and vicinity indicating the direction of the airport is poor. Delivery of public and private services is easily fast-tracked whenever they are required by the airport authority.

A number of air navigation service facilities such as beacons, DVOR and radar are installed in the city as property of KCAA. Nonetheless, a shared responsibility is needed between KCAA, the City County and the Government for the safety and security of the facilities. The regulation governing the operation of RPAS in Kenya is under development. The enhanced cooperation between airport and city through an articulated framework will contribute to airport and urban economies and lead towards development of fast track strategies aimed at attracting foreign investors.

The City of Ekurhuleni and the Airports Company of South Africa (ACSA-O.R. Tambo International Airport examples), illustrate good cooperation and collaboration between governments and airports, and could be a model for other Metropolitan Authorities hosting an international airport. This cooperation led to the adoption of an Aerotropolis development strategy which will ultimately contribute to increased business, trade and tourism as well as creation of jobs. ACSA is increasingly engaged in improving landside access of passengers, greeters and meters, and air cargo to the airport, as well as airport capacity utilization.

With regard to the land-use and the environment, ACSA ensures that ICAO requirements are complied with. Multi-sectoral activities concerning development are implemented through the National Development Plan. Transport is guided by the National Transport Master Plan. The National Civil Aviation Policy is articulated with the National Transport Master Plan. City Master Plans and Airport Master Plans are integrated and aligned to ensure seamless coordination in developing the country. A 30-year Aerotropolis Master Plan has recently been developed, together with the necessary proposed organizational structure, to streamline governance and regulatory procedures to support investment and development. South Africa is at an advanced stage in developing the very first Aerotropolis in the Eastern and Southern African Region.

The level of public transport services is very low, while infrastructure around OR Tambo International Airport provides capacity to increase such service as the city experiences road traffic congestion during morning and afternoon peak hour. Currently, only ten per cent of airports users travel by public transport. The planning is to move from private to public transport which is safer, more efficient and cleaner. Ekurhuleni Metro is currently constructing a Bus Rapid Transit System from the North of the City directly to the airport. Signage in the city providing directions to airport users is adequate. The Airports implement programmes on obstacle charting and identification.

RPAS are governed by specific regulation. Public and private services concerning water, energy, ICT, sewage and drainage are adequate to respond to the airport's needs. ATNS minimizes cost by sharing locations of Communication, Navigation and Surveillance (CNS) facilities with other institutions. Facilities owned by aviation and metropolitan stakeholders are sited on leased or owned land.

The benefits resulting from the Aerotropolis are numerous. Its activities are envisaged to increase air cargo, passenger traffic and economic growth resulting in increased GDP, new businesses, new routes, airlines competitiveness, best pricing and job creation. Efficient air transport operation with a wide network is one of the vehicles to attract FDI. Airlines and airports are major role-players to attract foreign investors. Open commercial arrangements with foreign airlines are supported taking into account balanced opportunities and benefits.

Lanseria International Airport is located in Johannesburg and it is exclusively private airport. The cooperation between the airport and the city is implemented at a low pace. Future development proposed for Lanseria in view of the Aerotropolis includes: mixed land use planning and development – low, medium and high-density housing project at Cosmo City and proposed Cradle City. There is retail, commercial, offices and industrial corridor to tap into this as well.

Lanseria International Airport is also impacted upon by the Cradle for Human Kind which is a World Heritage site. This international tourist site is coordinated between the City of Johannesburg and Mogale City Municipality. Signage in the city providing directions to airport users is adequate. The majority of airport users travel by private transport. Public and private services in terms of water, sewage, drainage, ICT and waste management are adequate to respond to the airport's needs.

To create the synergy between airport and urban development for sustainable development in implementing the SDGs under the 2030 Agenda, aviation and metropolitan authorities are required to develop necessary infrastructure which will enable to meet the demand of the growing urban population and air traffic, while limiting the impact on the environment.

ICAO and UN-Habitat are engaged in fostering this projected growth in a sustainable manner by respectively putting in place “No Country Left Behind” and “Leave No One Behind” initiatives. These two initiatives provide the way forward to fully implement the Strategic Objectives by ICAO on one hand, and urban settlement resilience under the New Urban Agenda by UN-Habitat on another.

This complementarity role emphasizes the need for the development of a framework that highlights the role of airports and cities in relation to infrastructure and services development in city and around the airport; and a study on the synergistic relation to sustainable development. The development of infrastructure plays a key role in providing adequate services. The trends in land use around the airport may determine the impact on airports and air traffic capacity. In this regard, land use should be in compliance with land use changes and urban planning regulations, socio-economic development plans, environmental management programmes for sustainable urban growth and existing internationally adopted rules.

This report highlights the synergies between ICAO Standards and Recommended Practices (SARPs) and guidance and the goals of UN-Habitat. The Airport Planning Manual Part 2, Land-use and Environmental Management is a principal document focused on the land use and environmental management on and around the airport. The purpose of this Manual is to provide effective practices at an airport to reduce the potential environmental effects caused by the airport and its operations. Aircraft noise being the primary concern of communities around the airports, the Airport Planning Manual Part 2 introduces a detailed approach to robust noise management, of which land-use planning and associated zoning policies are an integral part. Noise modelling allows for the development of noise maps that reflect the average sound exposure to aircraft around the airports. Noise contours are therefore defined in regular intervals (every 5dB or every 10 dB) and these maps can be produced for different times of exposure (day or night). Noise maps are key to the implementation of noise mitigation tools. Indeed, a zoning policy can be defined, that would identify a series of activities that are deemed compatible with various levels of noise exposure. Typically, industrial development would be considered as compatible with higher noise level exposure. These noise maps and related zoning policies are essential instruments for effective urban development on a territory that hosts an airport and urban planners and developers should integrate these tools in city master planning. Derived mitigation measures are building codes, noise insulation programmes, land acquisition and relocation, transaction assistance or real estate disclosure. Airport Planning Manual Part 1 is focused on master planning at airports, mainly in relation to operational safety and efficiency. The recommendations and considerations for airport planning from APM, Part 1 should be considered in conjunction with the information provided in APM, Part 2 to minimize environmental impacts.

ICAO's Guidance on the Balanced Approach to Aircraft Noise Management – Doc 9829, encompasses four principal elements: reduction of noise at source, land use planning and management, noise abatement operational procedures, and operating restrictions. Although these

principals have been globally developed, they should be implemented based on the local needs of individual airport and community needs.

ICAO's Circular 351 – Community Engagement for Aviation Environmental Management focusses on effective communication and consultation between airport and communities. The most common form of community engagement consists of the aviation industry providing information to community groups and individuals on aviation operations and development plans, and communicating the current and future environmental, social and economic benefits and impacts. It is this two-way dialogue and consultation between airports and communities assists in the sustainable development of the Aerotropolis. Community engagement should also be considered prior to any development in the vicinity of the airports. Indeed, communities often perceive the airport as one single entity. Therefore, all development plans or changes around the airport, even if they are not related to its aeronautical activities, shall entail a component on community engagement.

Although community engagement is often associated with noise management, other environmental aspects such as air quality, greenhouse gases, land use and waste management are becoming increasingly important, thus requiring effective environmental planning and management.

The four cities considered in the pilot project have different approaches in articulating the development between airports and urban settlements. All airports implement equally ICAO SARPs and policies related to infrastructure development and land use planning as part of the national civil aviation regulations. Cities are guided by urban policies. The current synergy between airports and urban development which includes infrastructure development are governed by stand-alone policies which make difficult joint oversight activities at the local and national level.

This situation lowers the expected economic sustainability. As a result, there is a need for ICAO and UN-Habitat to perceive the fostering of airports and metropolitan policies, respecting existing international SARPs and guidance, and to advance global guidelines building upon their respective expertise that would assist States in establishing sustainable approaches for new airport infrastructure and urban development. This will be of capital importance in contributing to optimal planning and implementation of development of infrastructure. The guidelines would address matters related to airports and metropolitan infrastructure development, land-use and planning, environment and capacity-building.

As noted, ICAO has developed effective Standards and Recommended Practices on land-use planning and environmental management, through contribution of more than 600 international experts and global consultation. Therefore, it is important that these documents remain the foundation of the cooperation between airports and cities.

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CHAPTER 1: PROJECT BACKGROUND

1.1 Introduction

1.1.1 This study report is based on a joint study initiated by ICAO and UN-Habitat to explore the ‘*Synergy between Airports and Urban Development for Sustainable Development*’.

1.1.2 The ongoing inter-agency activities within the UN System, led to ICAO and UN-Habitat co-operation to implement a pilot project regarding the New Urban Agenda under the Sustainable Development Goals. Airports and urban infrastructure should be clearly articulated within integrated urban master plans including airports’ master plans. The objective is to enable airports and cities to play a key role in interaction with concerned stakeholders with particular interest in planning, financing and legislation, thereby playing a lead role to more productive, safe and prosperous cities. This important connection between airports and cities has not often been clearly established. This project will be innovative and fill an important gap in the discourse for sustainable urban development worldwide.

1.1.3 ICAO has developed Standards and Recommended Practices to guide member States in airport master planning, engagement of stakeholders and environmental protection, and sustainable development. This includes *Airport Planning Manual Part 2, Land Use and Environmental Management*, ICAO Circular 351 *Community Engagement for Aviation Environmental Management*, and *Guidance on the Balanced Approach to Aircraft Noise Management - Doc 9829, Airport Air Quality Manual - Doc 9889, Operational Opportunities to Reduce Fuel Burn and Emissions – Doc 10013, Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes – Doc 10031, Report on Environmental Management System Practices in the Aviation Sector (2012)- Doc 9968*. These guidance documents recognize the synergies between sustainable airports and cities.

1.1.4 The United Nations system works towards the promotion of international peace and security, by promoting human welfare through environmental-friendly socio-economic development. On 25 September 2015, the UN General Assembly adopted the 2030 Agenda, which includes a set of 17 SDGs supported by 169 targets that balances the economic, social and environmental dimensions of sustainable development. ICAO is leading an agreed global indicator to monitor progress towards achieving SDG 9, Target 9.1 relating to infrastructure development: passenger and freight volumes carried by air transport. Further, the *Inter-Agency Task Force on Financing for Development Report for 2016* points at the percentage of EI in the technical area of AGA to monitor the quality, reliability, sustainability and reliance of the aerodrome infrastructure. Further, the Agenda 2030 calls for a global partnership that brings together Governments, private sector, civil society, UN system, and other actors to mobilize all available resources for its implementation.

1.1.5 UN-Habitat works towards socially, economically and environmentally sustainable human settlements; at the urban and rural level. As the world is urbanizing rapidly, urban areas are increasingly getting predisposed to be trend setters in social, political, economic and environmental strife. Sustainable urbanization is currently a pressing need, because management of urban and rural development patterns, and the provision of adequate shelter and associated services in urban and rural settlements, are needed more urgently and at an ever-increasing scale. ICAO and the aviation community also recognize the sustainable development pillars of social, economic and the environment. Thus, the common elements of sustainable development of both UN-Habitat and ICAO provide the framework for the synergies between airports and cities.

1.1.6 The relation between air travel and the core city leads to the emergence of development corridors to connect the two places. The corridors also attract land uses that supplement or complement the functions of the core city and the airport as a transport hub. The correct management of the development axis between the airport and the core city, and the regulation of land use activities

around airport facilities, are useful in ensuring sustainable land use development around the airport and along the corridor route. The environmental impacts of the development of corridors between the airport and city must be assessed. UN-Habitat has carried out several projects across the world on sustainable urbanization, human settlements, redistribution of urbanization dividends, and sustainable land use correlations in its quest to achieve socially and environmentally sustainable human settlements and adequate shelter for all. Thus, it brought into this project a wide array of international experience and best practices that will be relevant in achieving project goals.

1.1.7 Consistent with Article 44 of the Convention on International Civil Aviation (Doc 7300), one of the objectives of ICAO is to develop principles and techniques of international air navigation and foster the planning and development of international air transport, so as to *inter alia* meet the needs of the peoples of the world for such an air transport system. As noted, to achieve this objective, ICAO serves as the global forum for its 192 Member States and industry groups to reach consensus on SARPs, policies and global plans to coordinate multilateral strategic progress and growth of international air transport. In turn, Member States implement these SARPs, plans and policies, to ensure that their local civil aviation operations conform to global norms. This allows the effective operation of aviation's global network in every region of the world and its resulting socio-economic benefits, while limiting the impact of aviation activities on the environment. Currently, the implementation of the Convention on International Civil Aviation is supported by the ICAO strategic objectives which are safety, air navigation capacity and efficiency, security and facilitation, sustainable economic development, and environmental protection.

1.1.8 In addition to its standard-making activities, ICAO coordinates technical assistance and capacity development in States to achieve development objectives in the aviation sector, produces global plans to coordinate multilateral progress for safety and air navigation, produce reports on air transport performance metrics, audits of civil aviation oversight capacity for countries for safety and security, and provide guidance on airport land use and environmental management. Since its inception, ICAO has also undertaken major steps that have led to sustainable development of global air transport. ICAO has been a major advisor on the location of airport infrastructure in many countries. It is the UN specialized agency for international civil aviation and its guidance supports the establishment of relevant policy, the monitoring and evaluation processes of policies, programmes and projects. ICAO also undertakes capacity-building activities in the area of environmental protection.

1.1.9 This project focuses on the Eastern and Southern African regions. This area has steadily been growing around regional hubs in Johannesburg (Lanseria International Airport), Ekurhuleni (Oliver Tambo International Airport), Addis Ababa (Addis Ababa Bole International Airport) and Nairobi (Jomo Kenyatta International Airport and Wilson Airport). As a result, more people are transiting these airports, and subsequently increasing the demand for goods and services consumed within and around the airports, as well as beyond the individual countries, with huge impact on employment and business opportunities. This in turn translates into socio economic growth locally, nationally, regionally and globally due to the increased economic activities realized and other complementary effects in the economy.

1.1.10 The study report provides information on the following elements: project background; project case study airports including background; urban development and airports landside; airports and urban mobility; origin and destination cities air connectivity; land use planning; impacts of aviation on urbanization and socio economic activities; provision of public amenities and basic services in airports; current and emerging challenges to aviation; environment; and, sustainable urban and airport development.

1.2 Project Objective

The main objectives of the Project include:

1.2.1 Identify global good practices and principles in urban and regional planning and management around air transport infrastructure that can be applied to help sustainably develop air transport infrastructure and services to achieve airport-city (ies) development axis (corridors);

1.2.2 Assess and document trends and impacts of airports and air traffic on land use around the airport and along the airport-city corridor in selected airports to track land use changes and compliance to urban planning regulations, its related socio-economic and ecological impacts to sustainable urban development;

1.2.3 Develop conceptual, methodological, and operational spatial and visualization frameworks that will highlight the role of airport systems (infrastructure and services) to urban development beyond the city, along the airport-city axis and the airport-rural area trajectory; and study the synergistic relations to sustainable development; and

1.2.4 Foster further global guidelines building upon the respective expertise of ICAO and UN-Habitat that would assist States to establish sustainable approaches for new airport infrastructure and urban development and thus enhance the collaboration between airport and city administrations for optimal planning and implementation.

1.3 Project Location

1.3.1 Eastern Africa is the world's least urbanized region, however fastest urbanizing sub-region. Projections indicate that by the end of the current decade, the region's urban population will have increased by 50%; with the total number of urban dwellers by 2040 expected to be 5 times that of 2010. This colossal urban growth scenario essentially implies that the sub-region will face severe impacts of rapid urbanization such as an increased demand for affordable sustainable housing, transportation infrastructure and adequate generation of economic opportunities for the urban dwellers (UN-Habitat, 2014).

1.3.2 Southern Africa on the other hand, is the most urbanized region in sub-Saharan Africa, and is projected to reach an overall region-wide urban majority around the end of the current decade. Nevertheless, in 2011, only Angola, Botswana and the RSA had urban majorities. The other countries, apart from Swaziland, are expected to reach that point by 2050. Urbanization has progressed unevenly, between and within countries, and only Lesotho recorded a decline in urbanization levels since 2001 (UN-Habitat, 2014).

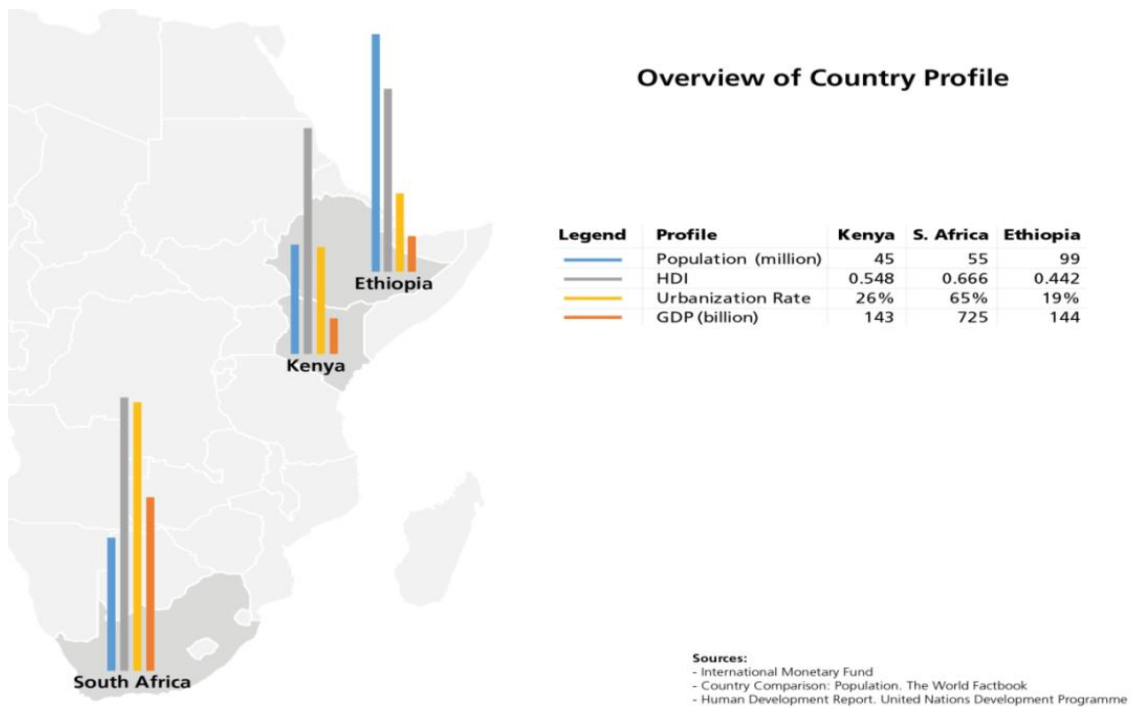
1.3.3 The Eastern, Southern Africa regions were selected as the study sites for this study. The regions have steadily been growing around regional hubs in Johannesburg, Addis Ababa and Nairobi. These hubs are projected to be handling over 36% of international air traffic in Africa¹. This implies that more people distend to or transiting through these airports and subsequent increased demand for goods and services consumed within and around the airports, and more employment opportunities. Eventually, this translates into socio economic growth of a city due to the increased economic activities realized and other complementary effects in the economy.

1.3.4 The project encompasses the following with studies spanning five airports:

- a) Kenya: Nairobi (Jomo Kenyatta International Airport and Wilson Airport);
- b) Ethiopia: Addis Ababa (Bole International Airport); and ,
- c) South Africa: Johannesburg (Lanseria Airport) and Ekurhuleni (OR Tambo International Airport)

¹ Africa Infrastructure Country Diagnostic: *Air Transport Challenges to Growth*, June, 2009, World Bank <http://siteresources.worldbank.org/EXTAIRTRANSPORT/Resources/515180-1262792532589/challenges.pdf>

Map 1: Overview of Country profiles



Source: IMF, UNDP (2015)

©Runze, 2016, Source: Airports Council International (2015)

The passenger numbers for these countries are different: highest in South Africa and lowest in Addis Ababa. In the distribution of air traffic from the studied countries, Kenya is centrally located but South Africa has the highest concentration of flows and airports.

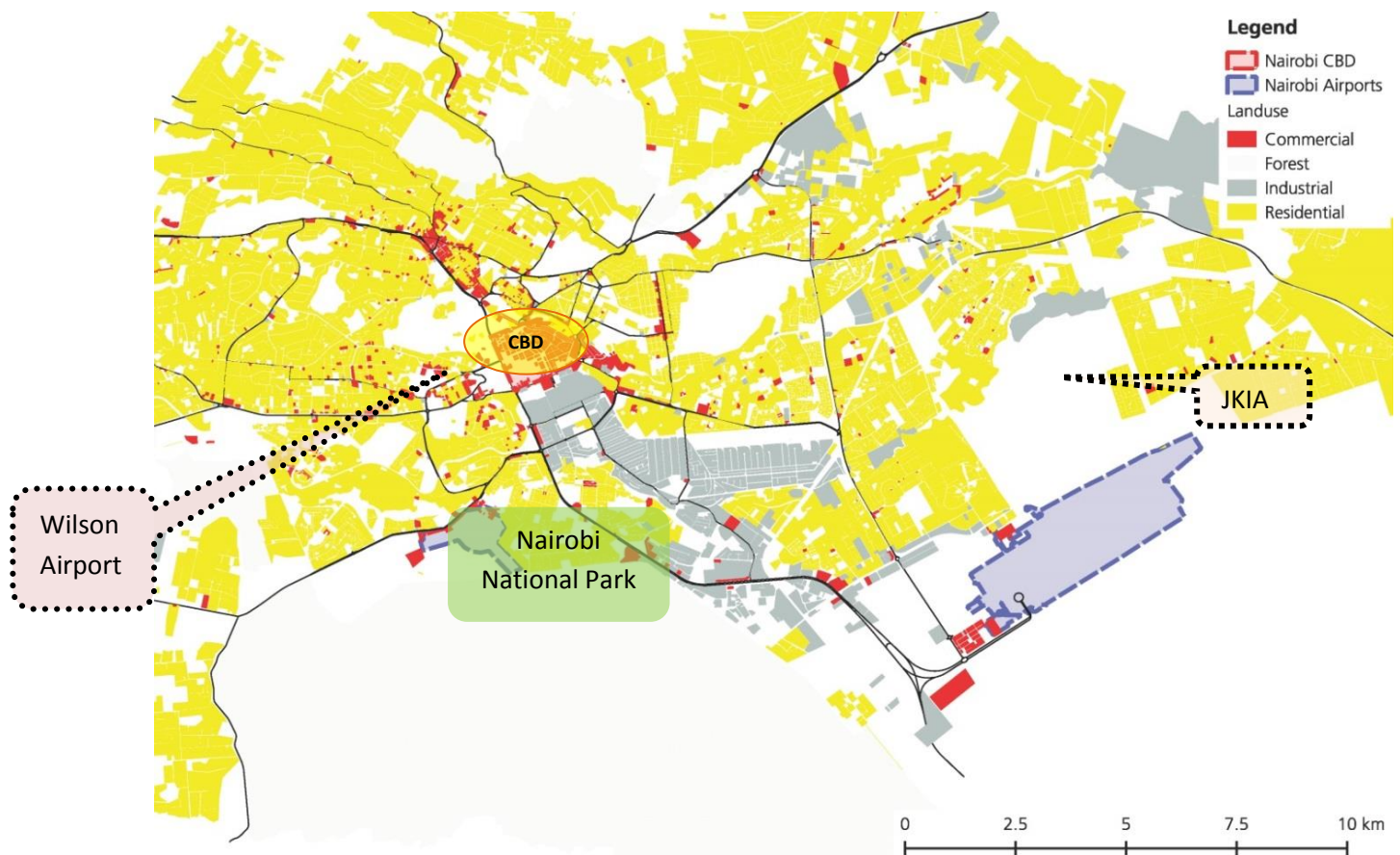
CHAPTER 2: PROJECT CASE STUDY AIRPORTS

2.1 Kenya

2.1.1 Jomo Kenyatta International Airport

Jomo Kenyatta International Airport (JKIA) is the busiest airport in East Africa; handling over 19,000 passengers daily. It is located 15 km southeast of the Nairobi CBD; in a sprawling, plain towards Athi River. It was opened in 1958 by the colonial government. It is a joint airport (military and civil airport operations). It is located at an altitude of 1624m above the sea level on 01°19'07"S 36°55'33"E. Its runway is on a 06/24 orientation with a 4,117-meter-long asphalt runway. In 2013, it handled 5,803,635 passengers. It has over 12 cargo airlines using the airport facilities².

Map 2: Location of JKIA and Wilson Airport in Nairobi and associated land uses

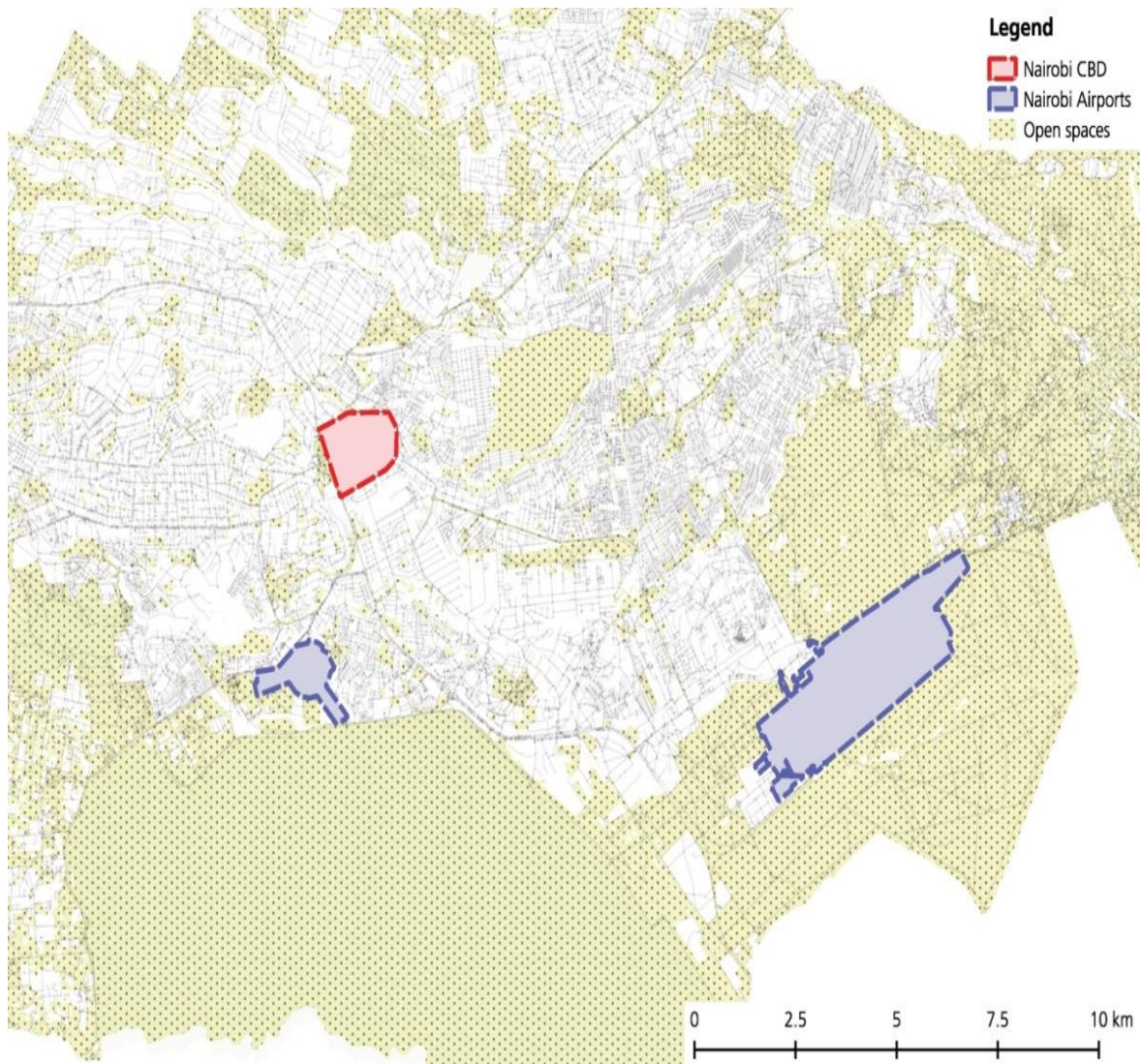


©Runze, 2016, Source: Adapted from Google Maps (2015)

The airport is bordered by two major roads going into Nairobi; Mombasa Road and the Eastern Bypass that connects Mombasa Road to Thika Road. The Eastern Bypass whose construction was completed in 2013 eased access into the airport from Thika Road and other roads from North East of Nairobi. This has reduced the dependence of Mombasa Road as the only access point into the airport; a major cause of traffic along the road. The entry into the airport is on Airport South Road, accessed on an exit from highway A109 (Mombasa Road).

² More data available on www.kaa.go.ke

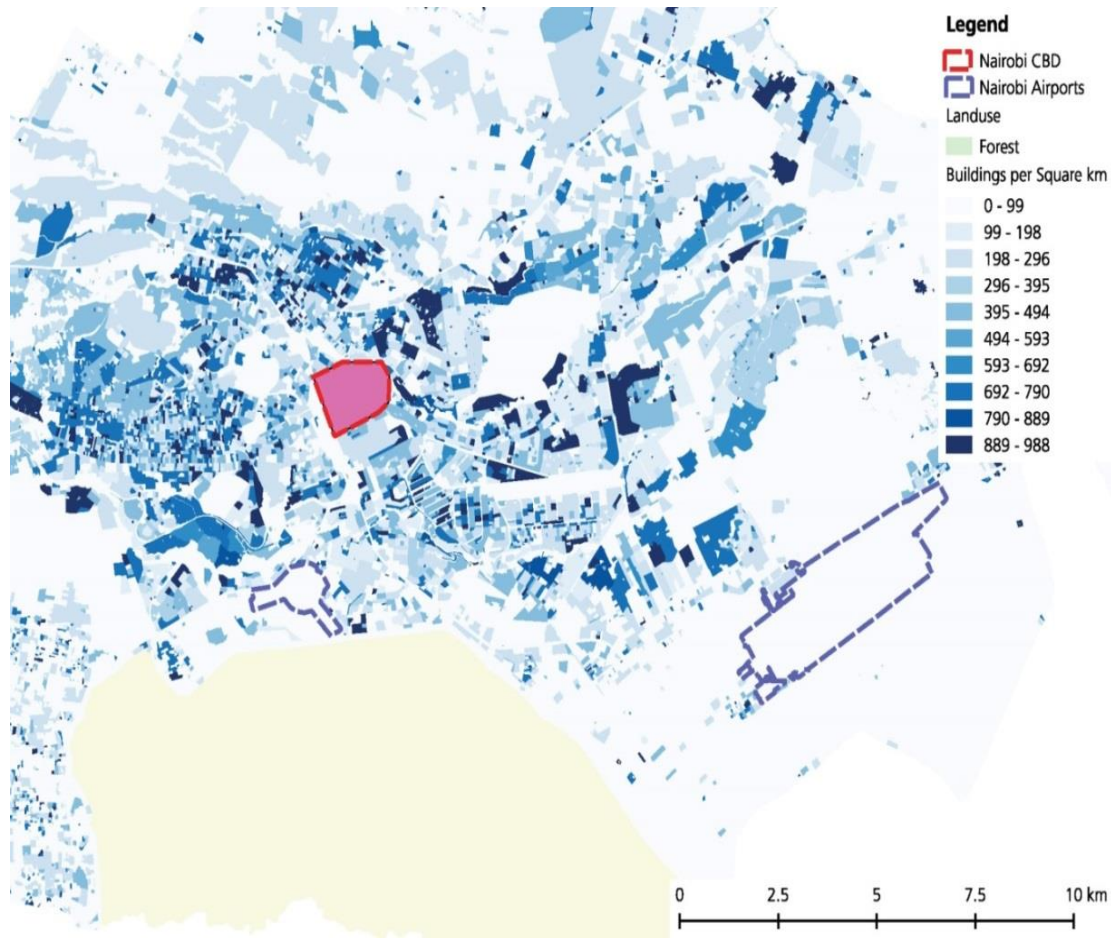
Map 3: Open land and airport location in Nairobi



©Runze, 2016, Source: Adapted from Google Maps (2015)

There is a reduction in building density especially close to JKIA, however it increases away from the airport.

Map 4: Building density map in Nairobi



©Runze, 2016, Source: Adapted from Google Maps (2015)

The Nairobi Commuter Train service at Syokimau is the closest rail link to the airport, but there is a planned extension of the railway into the airport to facilitate swift movement of passengers and goods between the airport and the CBD. JKIA serves many major global destinations (up to 50 countries) and is the hub of Kenya Airways, Fly 540 and Africa Express Airways.

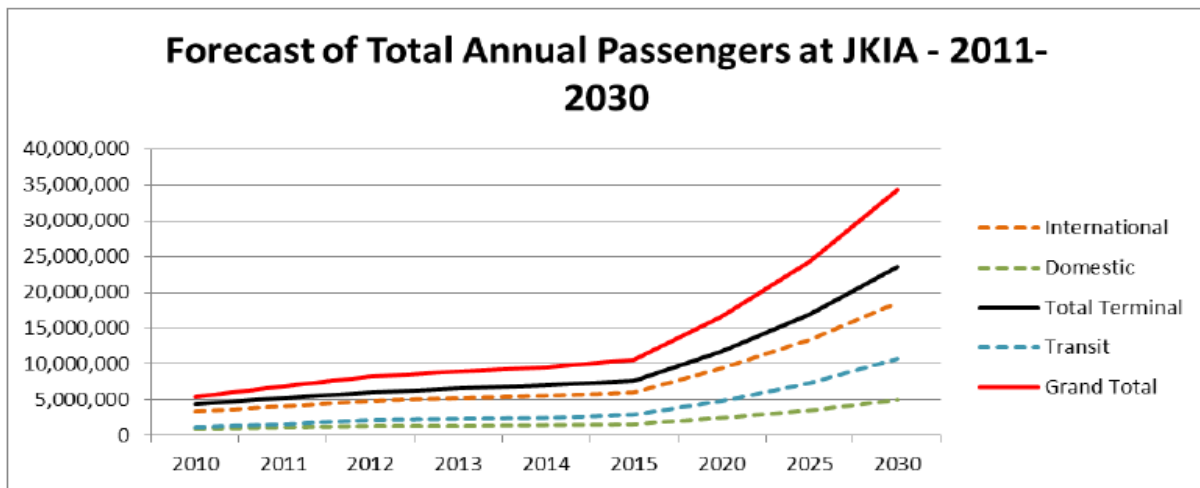
The airport is strategically located in Eastern Africa with an appropriate altitude to handle large passenger and cargo traffic, and a strategic position for regional and intercontinental connections. Initially designed to handle 2.5 million passengers, the airport now handles more than 6.5 million passengers annually. With an average growth of 12% per annum, the airport is projected to be handling over 25 million passengers by the year 2025.

Table 1: Present and projected Passenger Traffic at JKIA

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

Source: Kenya Airports Authority

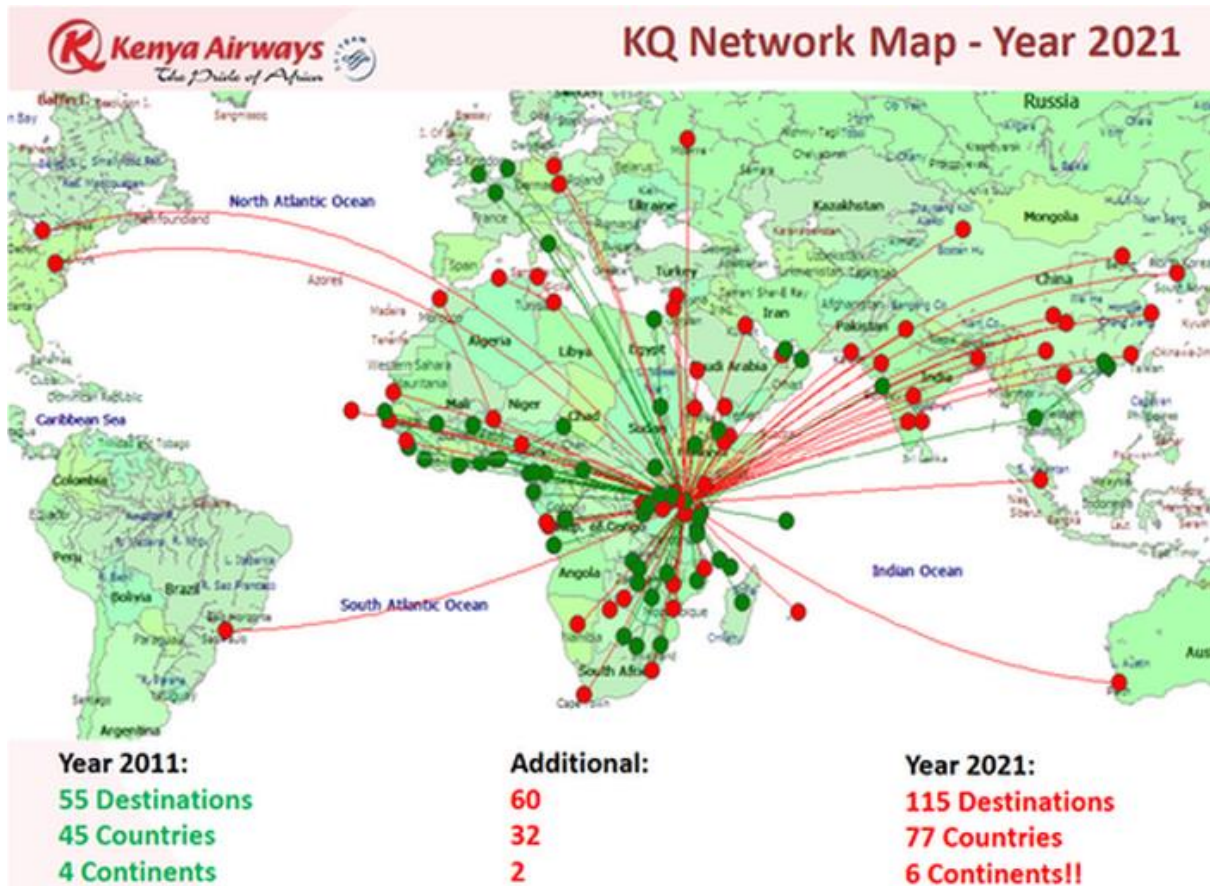
Figure 1: Projected Passenger numbers at JKIA (2011-2030)



Source: Kenya Airports Authority

The airport is the hub of Kenya Airways (KQ) which is seeking to widen its network of destinations to over 115 destinations by the year 2021.

Map 5: Kenya Airways Projected Route Network- 2021



Source: Kenya Airways

2.1.2 Wilson Airport

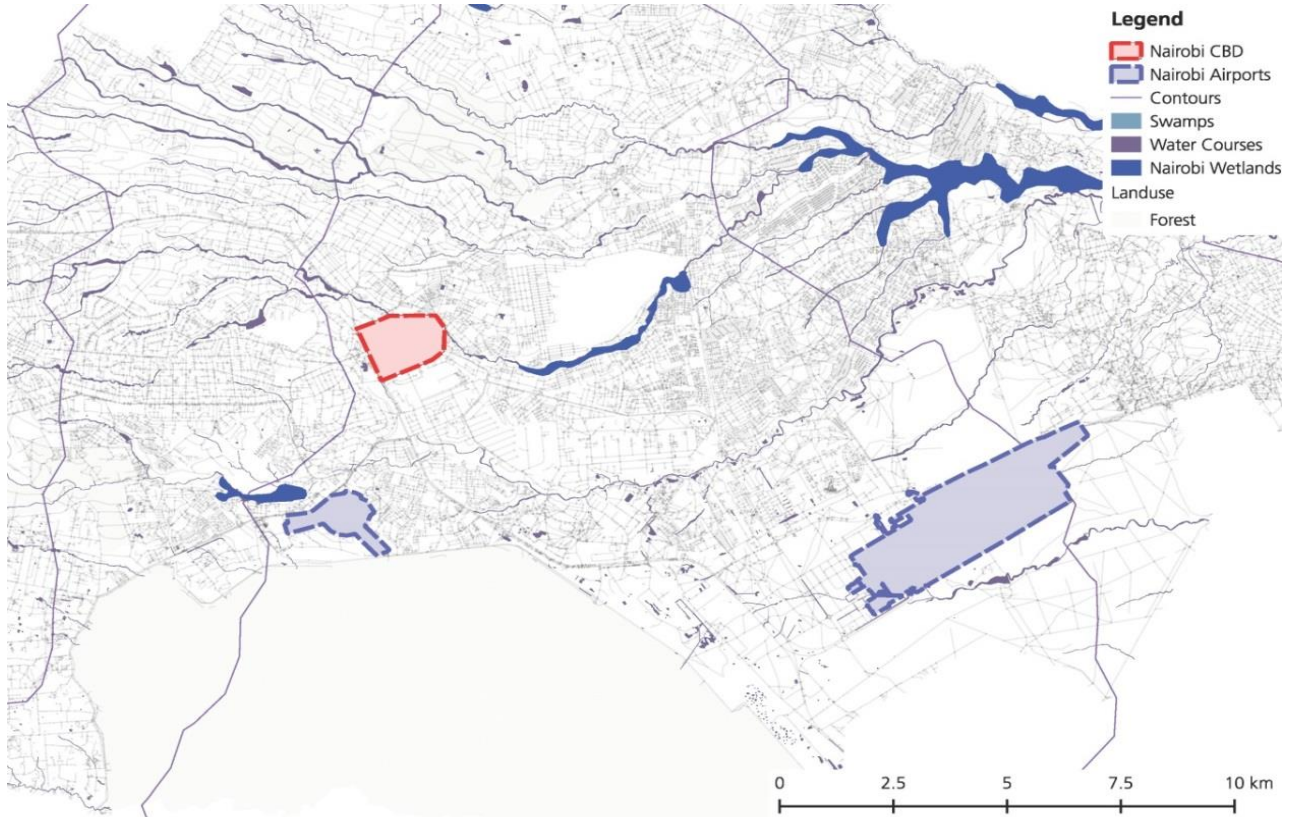
Wilson airport was established in 1928 as the Nairobi Aerodrome. It is located on latitude 1° 19' 0" N and longitude 36 48' 49" E, 5 km South of Nairobi CBD and borders the Nairobi National Park on its immediate south. It is an ICAO Class 2 category airport. It is the largest civilian airport in Kenya and the second busiest airport in Africa after Lanseria airport in South Africa. It is the busiest airport in its category in East and Central Africa (in traffic movements).

It is mainly used for domestic and regional commercial and chartered flights (90% domestic flights and 10% international flights). It is an operation hub for many operators notably; Safarilink, Delta Connection, AirKenya Express and Aircraft Cleaning Services, apart from hosting many aviation training organizations. It is located about 18 km West of Jomo Kenyatta International Airport. It is one of the busiest in its class as it averages about 120,000 landings annually. It primarily serves tourism, Medicare, agriculture and private aviation needs in Kenya and the region. Located 1,690 meters above sea level, it has two asphalt runways; with Runway 1 measuring 4,798 feet (1,462 m) long and 72 feet (22 m) wide; Runway 2 measures 5,052 feet (1,540 m) long 76 feet (23 m) wide.

Connected to the Nairobi CBD through Lang'ata Road, Wilson Airport has seen growth in its operations for an airport in its class. However, it has encroached on the airport and incompatible land uses such as high-rise buildings, slums and residential bungalows have been developed in very close vicinity of the airport. This has impacted the safety of the airport and halted its expansion strategy due

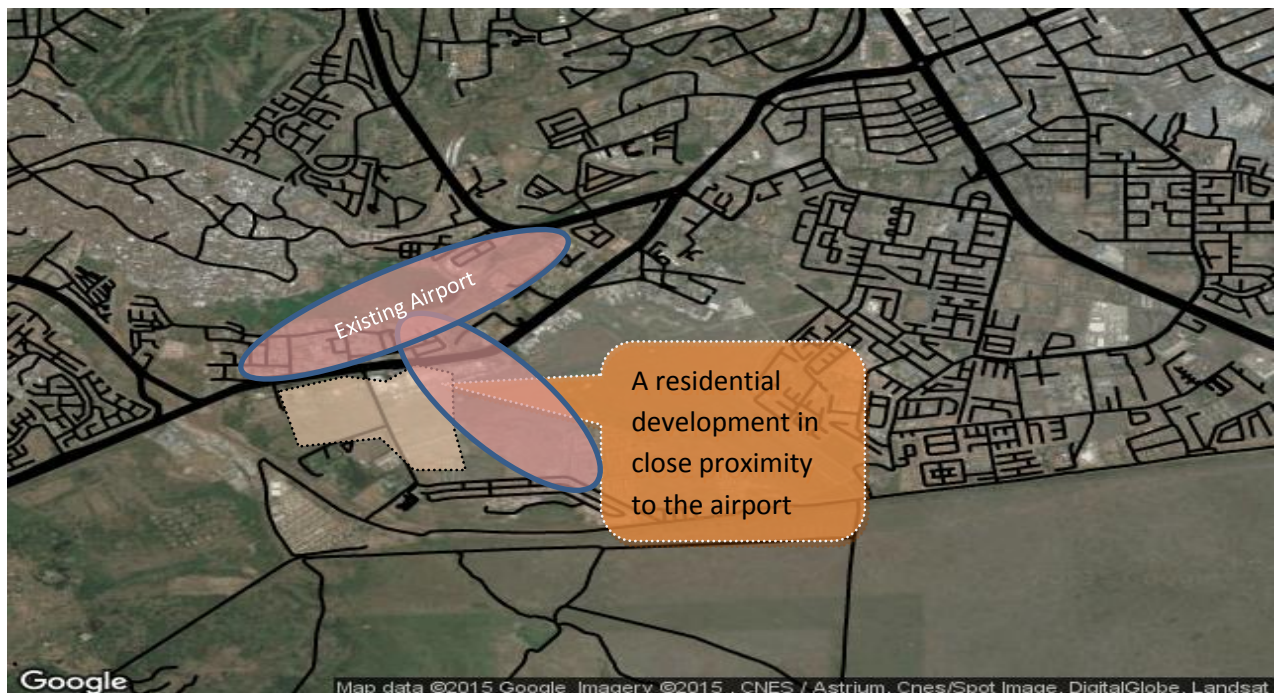
to unavailability of land. Land uses adjacent to Wilson include the Nairobi National Park, Jamhuri Park, low rise residential estates and recreational grounds. As indicated in map below the two airports (Jomo Kenyatta and Wilson Airport) are located on relatively flat land in Nairobi.

Map 6: Topography map of JKIA and Wilson Airports



©Runze, 2016, Source: Adapted from Google Maps (2015)

Map 7: Aerial View of Wilson Airport



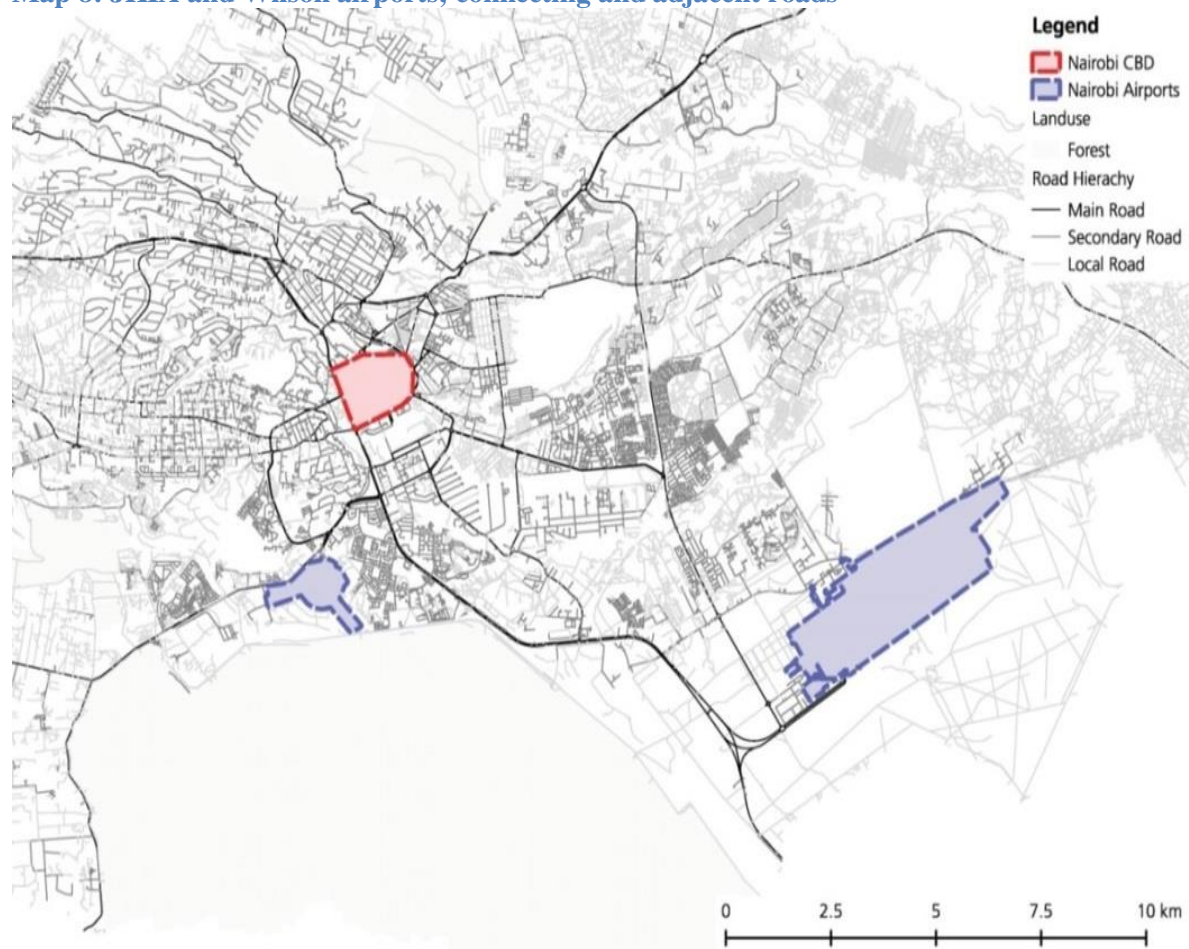
©Runze, 2016, Source: Adapted from Google Maps (2015)

Residential land use is close to both airports, though industrial and warehousing are prevalent in the proximity of JKIA. Part of the airport land has however been irregularly acquired especially in Wilson where there are apartments inside the airport property. Measures have been taken such as houses being demolished due to a shortage of land at the airport.

The two airports have connections to the city centre through the Uhuru Highway and are interconnected using Langa'ta Road and Mombasa Road).

On their flight paths is the Nairobi National Park and low-rise buildings characterize the vicinity of the two airports, although in Wilson Airport, there has been massive encroachment of airport land by private developers who put up residential buildings. Slum dwellers have also resided on the southern end of the south-facing runway.

Map 8: JKIA and Wilson airports; connecting and adjacent roads



©Runze, 2016, Source: Adapted from Google Maps (2015)

The flight path of the airport passes over the Nairobi National Park (landing) and the take-off is on a North Easterly direction; over Embakasi and Ruai. The Nairobi National Park provides good obstacle clearance on landing as it's open and expansive. The take-off flight path passes over government land with military training facilities and open grounds, which provide good obstacle clearance.

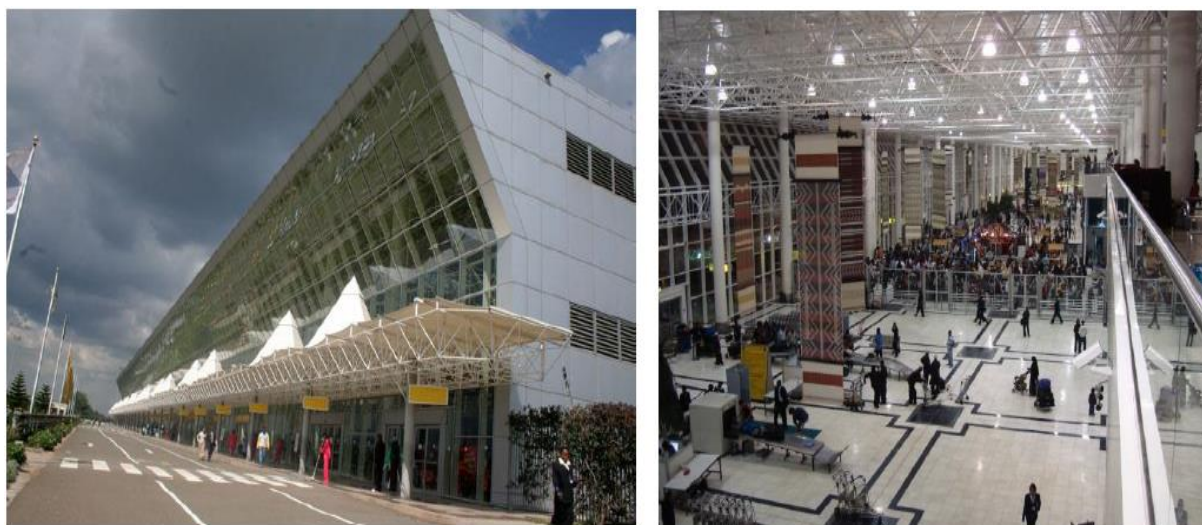
Owing to the strategic location of the Airport in Sub Saharan Africa; in relation to other destinations in the world and across the continent (to Europe, Asia, Americas and Australia), and the projected growth in passenger and cargo freight, the growth of the airport should be guided by effective land use procedures and guidelines, such as the Airport Planning Manual Part 2 (ICAO Doc 9184).

2.1.3. Ethiopia: Addis Ababa Bole International Airport

Ethiopia is a landlocked Horn of Africa country that borders Eritrea, Djibouti, Somalia, Sudan, and South Sudan. Home to more than 93 million people, it is the most populous land-locked country in Africa and second most-populous country in Africa, after Nigeria. With an ever-rising GDP, Ethiopia's aviation sector has also increased significantly. Ethiopian Airlines is an enterprise owned by the government and is a success in the African aviation sector; as it is one of the largest and most profitable carriers in Africa.

Bole International Airport was opened in 1950 as Haile Selassie International ADD Airport. It is located 8 km southeast of Addis Ababa city centre and is one of the busiest airports in Africa. The airport has two terminals; Terminal 1 used for domestic and regional operations, and Terminal 2 which is used for exclusively international operations. Terminal 2 consists of new facilities that were renovated and improved to a three-level steel and glass building that accommodates seven airline gates, a parking garage, shopping complex, restaurants and other airport facilities.

Figure 2: Bole International Airport



Source: Ethiopian Airports Enterprise

Initially built to handle half a million passengers, the airport was replanned in the 1980's to increase its capacity to 7 million passengers. Expansion activities ended in 2003 and it now has two parallel runways; 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. The airport can handle 44 aircraft simultaneously.

The airport is the operations hub for Ethiopian Airlines (ET); which commands a larger share of Africa's aviation market and has a large proportion of international destinations.

Map 9: Flight destinations and global air routes from Bole International Airport Ethiopian Airlines route network



Source: <http://addisababaonline.com/wp-content/uploads/2013/03/Ethiopian-Airlines-International-Route-map.jpg>

Currently the Ethiopian Airports Enterprise expanding the airport to enhance the capacity of the passenger terminal and constructing a cargo terminal that will handle 1.2 million tons of cargo annually.

Once the optimum capacity of the planned airport is reached, there are still plans to build a brand-new airport on the western periphery of Addis Ababa, leaving Bole International Airport for domestic, regional, and VIP travel as the new airport will be dedicated to international operations and long-haul flights³.

With an increased trend in air traffic and the move by airport authorities to plan for higher passenger numbers and larger cargo terminals, there is an indication that airports are growing larger, and that their role in national economic growth is becoming more significant. Their impact on socioeconomic development is also growing. Being located in urban areas and with an indicated rapid rise in urban growth in Africa, airports in Africa are becoming an important element in urban land use planning. Their influence in the urban planning and design cycle cannot thereby be ignored. There requires a careful investigation to determine the extent to which they are affecting urban growth and rural development.

2.1.4 South Africa

Located in the southern tip of Africa, it borders Namibia, Botswana, Zimbabwe, Swaziland and Lesotho. It has a booming economy with a high GDP per capita and very high tourism rates. The successful industry and economy in South Africa have promoted a successful aviation sector in the Country.

³ The Reporter: Ethiopia new airport
<https://archiveenglish.thereporterethiopia.com/content/ethiopia-break-ground-new-mega-airport-project>

2.1.4.1 OR Tambo International Airport

The Airport was founded in 1952 as the Jan Smuts Airport, later renamed in 1994 as the Johannesburg International Airport and finally renamed into OR Tambo International Airport in November 2006. Located in Ekurhuleni Metropolitan Municipality, it is South Africa's main airport, handling more than half of the country's aviation traffic. It is the largest and busiest airport in Africa, serving non-stop flights to five continents except Antarctica; and the fourth busiest in Africa and Middle East (After Dubai International Airport, Doha International Airport and Abu Dhabi International Airports). The airport is the hub for South African Airways and serves more than 19 million passengers annually⁴. It also experienced 217,600 aircraft movements in the financial year 2014/2015⁵. It has a capacity of handling 28 million passengers annually and has 95 international connections.

Figure 3: ORTIA Cargo and Passenger impressions



Source: Ekurhuleni Metropolitan Municipality

It is an award-winning Airport; having received fourth place in Best Airport ACI-ASQ Awards for Middle East and Africa.

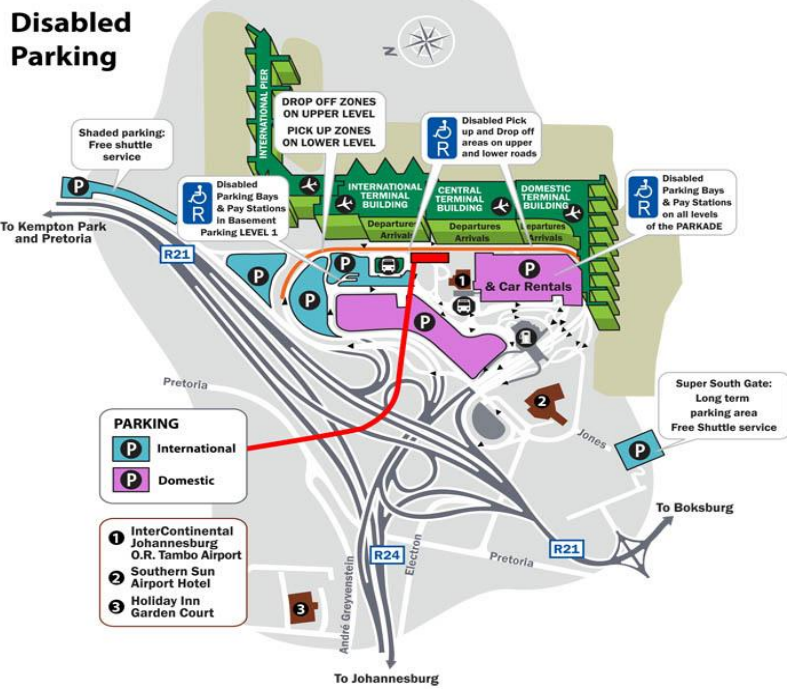
The airport houses six terminals that are divided into three major areas:

- Terminal A: International operations
- Terminal B: Domestic operations
- Central Terminal Building: a transit link terminal for domestic and international terminals

⁴ <http://www.acsa.co.za/airports/or-tambo-international> and http://www.acsa.co.za/ORTIA/Statistics/O.R.Tambo_Passenger_Traffic_Dec2015.pdf

⁵ http://www.acsa.co.za/ORTIA/Statistics/O.R.Tambo_Aircraft_Movements_Dec2015.pdf

Map 10: Facilities at OR Tambo International Airport



Source : <http://or-tambo.co.za/wp-content/uploads/2014/04/or-tambo-airport-disabled-parking.jpg>

Figure 4: An Aerial view of Tambo International Airport



Source : <http://www.johannesburg-airport.com/>

The airport has two parallel runways on a North-South axis and a closed cross-runway. The western runway is oriented 03L/21R and has a length of 4,418m; while. The Eastern runway is 3,400m long. They both have an Instrument Landing System (ILS).

Map 11: Aerial View of OR Tambo International Airport



Source: Google Maps

The western runway is one of the world’s longest international airport runways. This is required for a rarefied atmospheric problem in Johannesburg, where a fully laden aircraft needs a longer runway to achieve take-off velocity more than normal. OR Tambo is thereby regarded as a “hot and high” airport because it is situated at almost 1,700m (5,500ft) above mean sea level and the air is thin at that altitude. This results in decreased performance in aircrafts departing from the airport⁶.

It is the hub for South African Airways, South African Express, Airlink, Comair, Interair South Africa, Mango and Kulula.

In the run-up to the 2010 FIFA World Cup, the Gautrain Rapid Rail Link was constructed to the airport, among other facelifts that gave OR Tambo a world class status. The project involved the following key expansion activities:

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

Figure 5: OR Tambo International Airport Development Plan



Source : <https://www.airport-technology.com/projects/johannesburg/attachment/johannesburg4/>

The total cost of the expansion was estimated to be 497 million USD.

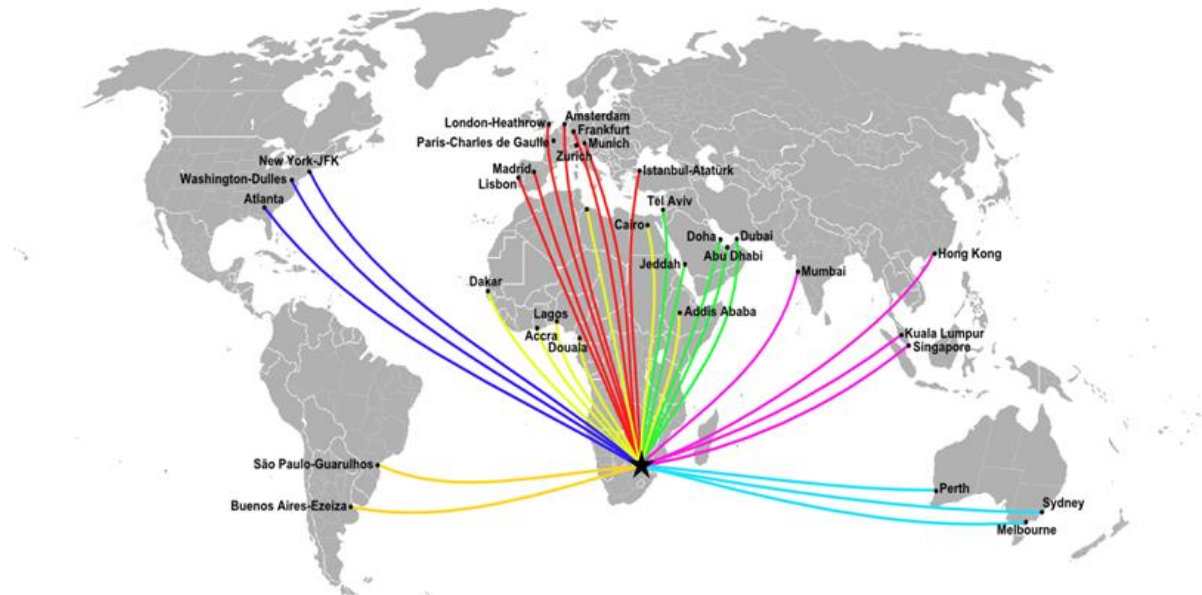
⁶ Airport-Technology.com: Oliver R Tambo (Johannesburg) International Airport (JNB/FAJS), South Africa <http://www.airport-technology.com/projects/johannesburg/>

Figure 6: The Gautrain Station at OR Tambo International Airport Station



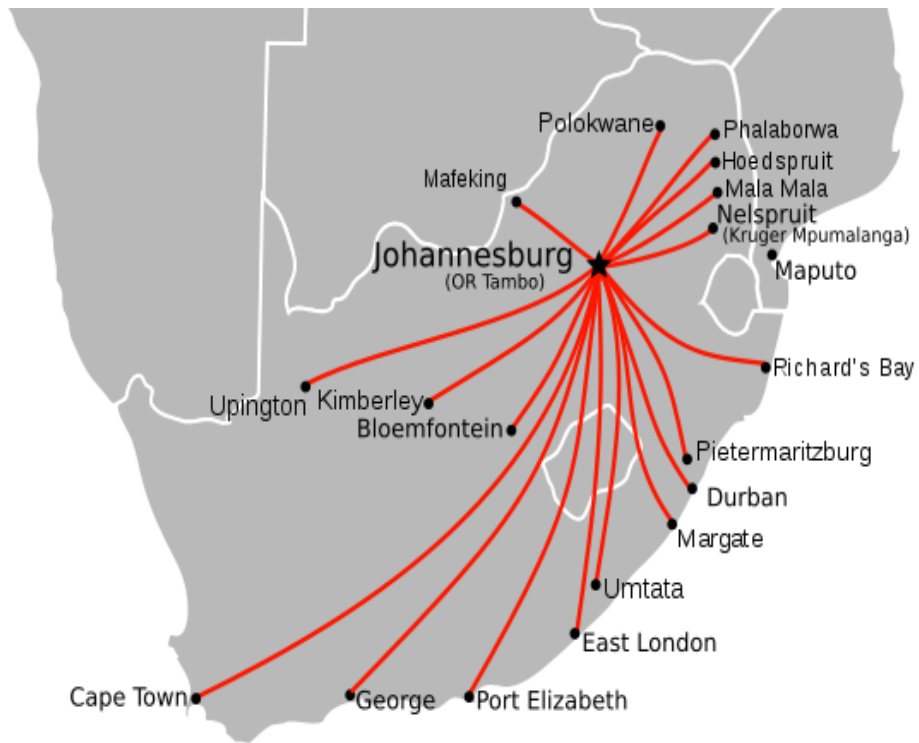
Source : <http://www.southafrica.to/transport/Airports/O-R-Tambo-International/O-R-Tambo-International-Airport.php5>

MAP 11.1: International flights from OR Tambo International Airport



Source : <http://www.johannesburg-airport.com/flights.html>

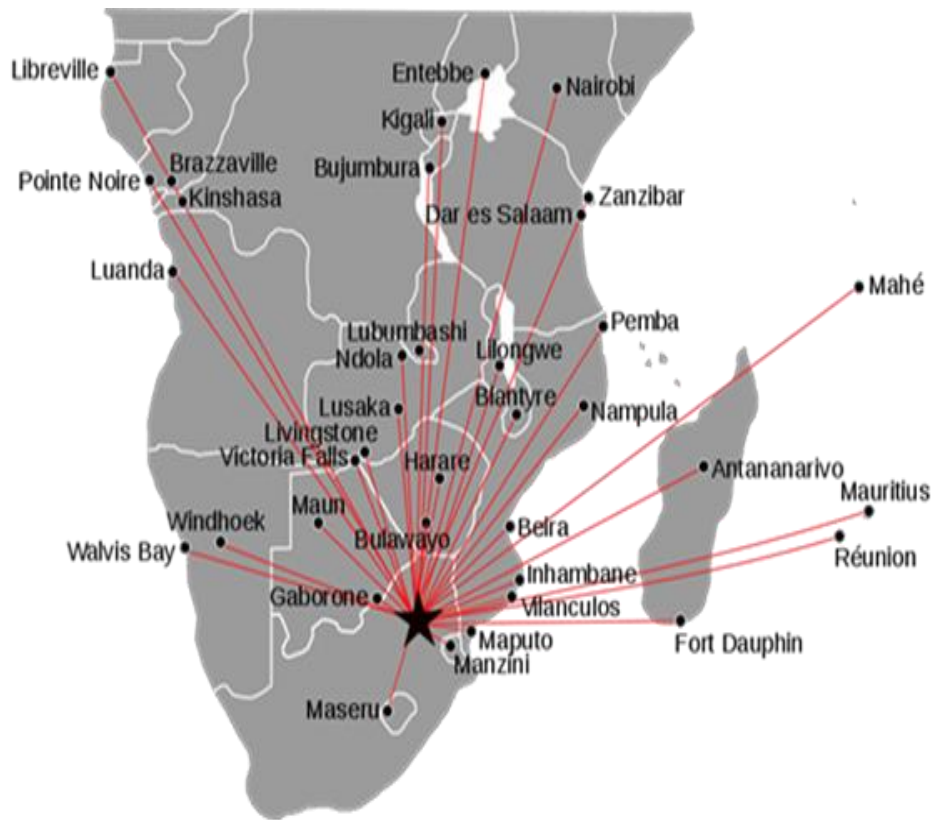
MAP 11.2: Domestic flights from OR Tambo International Airport



Source :

https://commons.wikimedia.org/wiki/File:Domestic_Flights_from_johannesburg_International_Airport.svg

MAP 11.3: Regional flights from OR Tambo International Airport

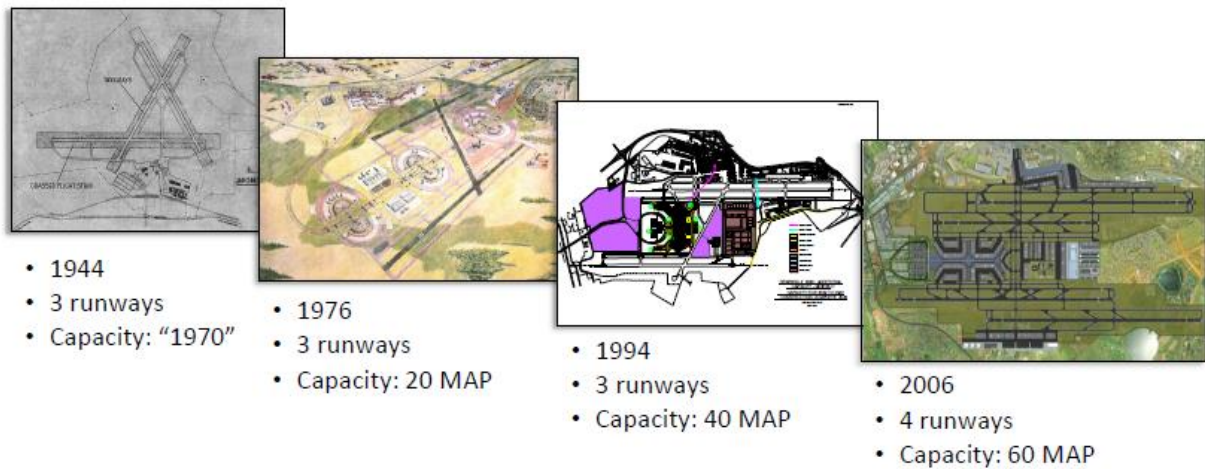


Source : https://commons.wikimedia.org/wiki/File:Regional_Flights_from_johannesburg.svg

OR Tambo is under plans to be expanded further, with the Airports Company South Africa (ACSA) intending to convert it into an Aerotropolis.

Figure 7: Evolution of ORTIA

Evolution of Airport Master Plans



Source: Ekurhuleni Metropolitan Municipality

2.1.5 Lanseria International Airport

Established in 1974, Lanseria is a privately owned but internationally accredited Airport in South Africa. It is closer to Pretoria, Sandton, Westrand, and Midrand regions. It has two runways; and can handle larger aircraft due to recent upgrades of the runway.

Figure 8: Entrance into the Lanseria Airport



Source : <http://lanseria.co.za/pages/gallery>

It operates commercial and private flights from the airport. Kulula.com and Mango have operational hubs at the airport. It was granted an international airport status in 2012. Its facilities include an

upgraded terminal building, restaurants, duty free shops, lounge facilities, ample parking, easy flow pick up and drop off area and an improved toll-free road to the Airport.

In reviewing the land uses around OR Tambo and Lanseria, residential, commercial and industrial land uses feature close to the airports as attenuated in the map below. There is higher density of land use development around OR Tambo; which is closer to the CBD while there is more diffused development around Lanseria airport.

2.2 Conclusion

2.2.1 The case studies have indicated growing and viable prospects in the aviation sector of their respective countries. The plans to keep expanding and making airport cities around the airports are clear indicators that growth is a projected fact. The African Development Bank indicated that the air transport demand in Africa has seen a steady increase because of *economic growth, a growing population, a growing middle class* that can afford air services and *increasing urbanization*⁷

2.2.2 These airports have thereby indicated a correlation between airports and the urban design of the cities they are located in. They affect the location of activities around them, and with projected growth, they are bound to have an increased footprint on the land they occupy, as well as monumental impacts on urban development and land uses of the cities and rural regions they are located. Careful assessment should thus be made to ensure the social, environmental and economic returns of the airports are well distributed within the cities and regions of location for positive growth to be realized.

This assessment should be done with the objective of meeting the goals and objectives of ICAO and UN-Habitat in order to promote the synergies between airports and cities with respect to environmental protection, based on internationally available guidance documents.

⁷ African Development Bank: Jomo Kenyatta International Airport Emergency Interim. Terminal Construction Project, October, 2013 [https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Kenya - Jomo Kenyatta International Airport Emergency Interim Terminal Construction - Appraisal Report.pdf](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Kenya_-_Jomo_Kenyatta_International_Airport_Emergency_Interim_Terminal_Construction_-_Appraisal_Report.pdf)

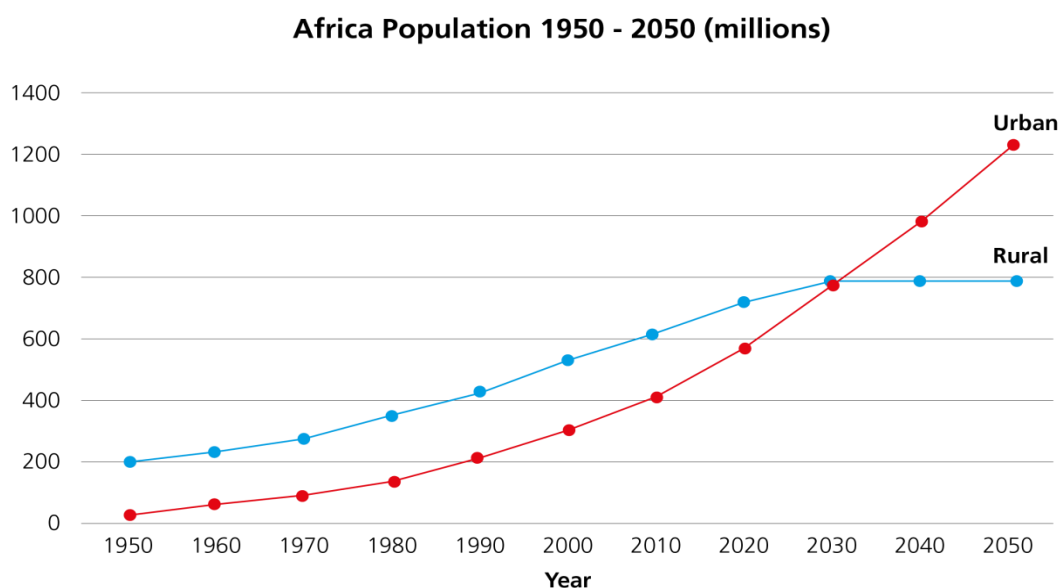
CHAPTER 3: URBAN DEVELOPMENT AND AIRPORTS LANDSIDE

3.1 Urban Development

3.1.1 The world is undergoing rapid urbanization. Globally, more people currently reside in urban areas than rural areas (UN-Habitat, 2013). The population balance between urban and rural areas has been shifting over time. In 1930 for example, only 30% of the global population was urban and by 2008, half of the world's population was urban (Soja & Kanai, 2007; UN-Habitat, 2013). Currently, the urban population stands at 54%; a proportion projected to rise to 66% by 2050 (UN DESA, 2014). Africa and Asia form the least urbanized regions in the world respectively, but have the fastest global urbanization rate KPMG (2012). It is postulated that over the next 40 years, these two continents will account for 86% of the cumulative global urban growth. For example, the urban population in Africa rose from 15% in 1960 to over 40% by 2010. This growth is projected to reach 60% by the year 2060 (UN-Habitat & UNEP, 2010)

3.1.2 Since the 1996 Proclamation of the Habitat Agenda and the Istanbul Plan of Action, the demographic domain of Africa has undergone profound growth, at the rural and urban scales (Kharas & Biau, 2014). For most urban areas in Africa, the urban population is expected to triple in the next 50 years. This growth is coextensive with development trends in most emerging economies and developing countries; the economies of most African countries grew by more than 5% annually (World Bank & I.M.F, 2004). In the global arena, most countries' urban areas contribute more than 50% of the requisite countries' GDP (some countries' have an urban GDP contribution of up to 80%)⁸, indicating that densities resulting from urban development are critical for large scale economic prosperity due to agglomeration economies (J Vernon Henderson, 2000; UN-Habitat & UNECA, 2008). Thus, Urban growth is necessary to sustain accelerated economic growth and shared prosperity in Africa and the developing world (J. V. Henderson, 2010; Venables, 2010; World Bank, 2008; World Bank & I.M.F, 2014).

Figure 9: Africa's Urban and Rural Growth from 1950 and Projections to 2050



Source: Adapted from UN DESA (2014)

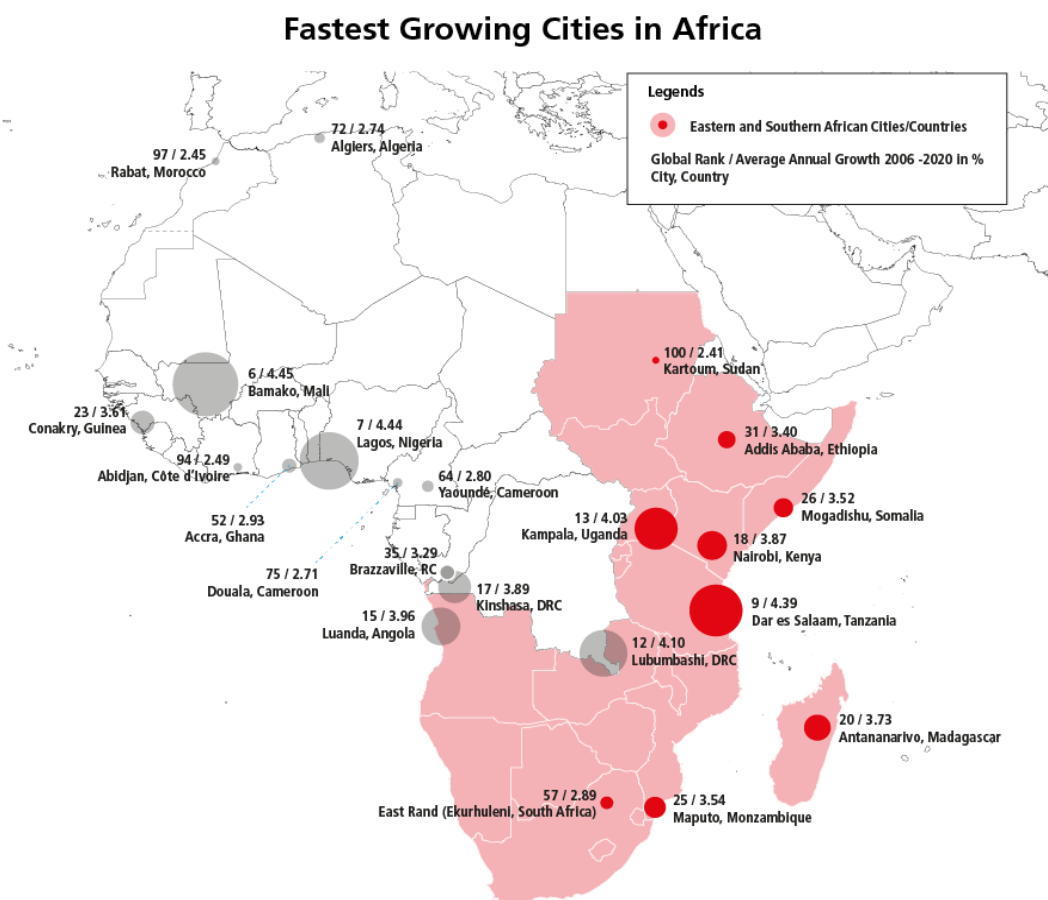
⁸ More information can be accessed from the KPMG Report on Africa: *The Role of Cities in Africa's Rise*

3.1.3 With an annual growth rate of 3.36 per cent per year from 2005 to 2010, African urban areas are growing 1.7 times faster than the urban growth rate of the world in the same period. This means that some urban centres will double their population in 15 years, others even in a shorter period. Projections indicate that populations of the cities of Lagos, Cairo and Kinshasa will surpass 12 million by 2020.

3.1.4 Africa’s population reached the one billion mark in 2009. It was estimated that by 2017, Africa’s urban population would be 569 million people, which will be larger than the total urban population of Europe at 553 million people. It will also be larger than the urban population of Latin America and the Caribbean which will stand at 533 million people.

3.1.5 In the 21st century African context, urbanization is one of the most transformative force the continent will experience (African Union & I.M.F, 2012). The urban population in Africa is projected to triple in the next 50 years, thus drastically changing the demographic profile of many African countries and exerting new development challenges on policy makers (Monga & Lin, 2015). This will present an excellent opportunity to realize sustainable urbanization (AfDB, 2013). Innovations towards African urban challenges will be key in generating appropriate urban development models that will propel African cities into prosperity (World Bank, 2013). It will present opportunities and challenges for housing and urban development in Africa.

Map 12: Urban Growth in Select African Cities



©Runze, 2016, Source: Adapted from Citymayors.com⁹ (2015)

3.1.6 Although urbanization and economic growth has not complemented one another in Africa, the relationship between level of urbanization and GDP per capita from 1960 to 2010 is positive with a moderate correlation. Low income countries have a very low level of urbanization; concomitantly high-income economies are highly urbanized. In fact, over 60% of GNP in African countries is generated from urban centres. In this respect, urbanization in itself provides vital opportunities in the Continent for positive economic development such as industrialization and entry into export markets, as well as social and human advancement. Urban centres create economies of agglomeration that are important to sustain economic growth and generate jobs and opportunities. Cities and towns are also attracting national and foreign investments

3.2 Airports Landside

3.2.1 A landside system (landside) is where aviation operations meet land-based systems. Landside includes all passenger movement to and from the airplane through the terminal along with the transportation circulation elements used to deliver passengers, their baggage, freight and employees and equipment required to support all airport operations. The aim is to provide safe, comfortable, convenient and speedy movement of passengers, baggage and freight between air and ground transport at the most effective cost. The limit with airside is defined by the security requirements at the gate to an aircraft, and associated control points.

It should also be noted that the airport landside is not limited to the movement of people and goods. It represents the functions and operations of the airport, and provides the interaction with the urban and regional community. The landside includes the airport terminal and supporting infrastructure, and associated operations, support facilities including heating plants, energy power generation, waste facilities, water management facilities, airport operations and maintenance, roadways, A landside system should be able to accommodate expanding traffic without extensive modification through obvious flow routes and separation of functions. Size of the facilities and their arrangement should provide the optimum relationship to each other and in accordance with the flow principles.

In all aspects of landside operations, environmental management must be incorporated into operations. This will include the management of wastewater, the disposal of liquid and solid wastes, energy efficiency, environmental emergency plans and procedures, and air quality management for local air quality and greenhouse gases. Environmental management must be done between the airport and communities, through the implementation of community engagement activities, to ensure that all applicable policies, guidelines and regulations are met or exceeded. This leads to sustainable development synergies between the airport and communities it serves.

3.2.2 The airport landside system should be designed to provide all necessary facilities to meet the needs of the airport and community. Implementation of these elements furthers the goal of sustainable development. Various requirements and modes include additional costs to the airport e.g. facilities for invalids, disabled and elderly persons, however, others can bring in revenue (e.g. concessions). Minimum costs for the airport will be achieved by the most continuous and homogeneous use of facilities and passenger convenience, which will be enhanced by reduction of interchange between various sections of the passenger area or buildings. Airports should be planned and designed to minimize the distance for the passenger to travel in the terminal, and encouraging interaction with goods and services. Thus, between the partly conflicting interests of the airport authority, aircraft operators and passengers, a compromise is necessary to determine the optimum distribution of facilities. Information for determining passenger building requirements should be obtained from all

⁹ http://www.citymayors.com/statistics/urban_growth1.html : The tables provide assumed annual growth rates for the top 100 cities and urban areas between 2006 and 2020. The assumptions are based on past growth/decline and forecasts by international and national statistics organizations

present and potential users of the facilities. The criteria should be analysed and agreed upon by all parties involved before being incorporated into the airport master plan.

The airport master plan should not be isolated to the confines of the airport proper, but also within the urban and regional setting. It should reflect on the socio, economic and environmental pillars of sustainable development, but also encompass the interaction between the airport and community requirements of transportation corridors and public transport.

3.2.3 Passengers should be thought as a homogeneous flow (constant or intermittent) which require clear indication of what they are expected to do and dedicated flow routes. Landside should attract passengers to the routes required by the flow and gives some freedom for individual needs. Passenger flow should be integrated with the baggage flow. They have equal importance but, because baggage is inanimate, it is easier to make the baggage flow compatible with the optimum passenger flow. In practice, the flow plans should be tested against one another at all stages. Flow principles to consider with respect to passengers include (following principles should be used only as far as is practicable):

- Routes should be short, direct (preferable - one direction) and self-evident. They should not, conflict with nor cross other flow routes;
- Changes in level of pedestrian routes should be avoided;
- Passengers should be able to proceed through a building without the need to rely on guidance or instruction from staff. The flow system should be for "trickle flow" rather than controlled movement in groups;
- In heavy traffic conditions, mass flows can only be achieved by the use of trunk routes.
- Particular categories of passengers should be diverted from the main flow route to pass through specific controls only at the last point on the main flow route where the character of the traffic changes;
- Possible to check baggage at the earliest possible point upon entry into the system.
- Free flow should be interrupted as little as possible (despite of necessary control and procedures);
- Passengers should pass through the same type of control only once;
- The last control should be security;
- Any controls established for screening of passengers and their hand baggage should be sufficiently remote from the boarding area;
- Flow routes should be planned to give visual continuity to the maximum possible extent. As a minimum, it is essential that there should be visual continuity from one functional stage of the flow route to the next;
- Features should be clear and easily readable in order to minimize uncertainty which cause uncertainty (ambiguous terminology on signs, flow routes which appear to lead in the wrong direction and multi-directional junctions) should be avoided;
- The speed of flow and capacity of the passenger routes should be matched to that of other systems, such as baggage flow and aircraft departure and arrival banks and turnaround time, and to the over-all capacity of the airport.

3.2.4 Effective planning and management of the airport includes land use planning and environmental management which are key to achieve compatibility of an airport with its environs. The aim is to provide the best possible conditions for the needs of the airport, the community and environment in surrounding areas. The Airport Planning Manual Part 2 – Land Use and Environmental Management provides guidance on effective airport land use planning, environmental impact assessment, and environmental management.

Airport planning and development should be an integral part of an area-wide comprehensive planning programme. Airport master plans require consultation between the airport and community. They should reflect the goals and objectives of a national transportation system meeting local requirements.

Community engagement is necessary to ensure that with any addition to airport operations, needs of the community are respected, as well as local planning and environmental guidelines are met.

The airport planning process should follow an environmental impact assessment, based on State requirements. This assessment should include air, water, waste, and noise elements, and incorporate social, and economic pillars. Based on effective consultation of the community and representatives of the industry, challenges and opportunities can be identified for mutual consideration. This builds upon the necessary trust between the airport and community, and enhances the synergies between both towards sustainable development.

Airports can incorporate environmental management plans and procedures with land-use planning as part of the environmental impact assessment, and are often identified as recommendations to move forward. Environmental management plans incorporate best practices to prevent pollution instead of control and finding ways to dispose of them. Pollution prevention can be defined as “the use of materials, processes or practices that reduce or eliminate the creation of pollutants and wastes at the source.” It includes practices that reduce the use of hazardous and non-hazardous materials, energy, water or other resources. Anticipatory action is used to pre-empt the need for control or remedy.

The environmental management activities of an airport can be divided into four basic categories: planning; operations and monitoring; mitigation and remedial measures; and environmental awareness.

Most environmental activities at airports involve planning and monitoring, including: environmental impact assessments; monitoring and compliance; environmental audits, where necessary; and environmental emergency contingency plans.

ICAO Doc 9968 Report on Environmental Management Systems (EMS) and Practices in the Aviation Sector (2012) outlines the adoption of an EMS at airports to ensure management of activities. Airports have adopted the principles of ISO 14001 Guidance on Implementation of Environmental Management Systems (EMS), and in many cases, airports have been certified under these standards.

3.2.5 There is a need for public control of land in the vicinity of an airport especially with:

- Height limitations of surroundings building;
- Obstacles to flight into/out of airport;
- Activities that could cause electrical interference with radio communications and navigation aids;
- lights that might confuse pilots in the clear interpretation of aeronautical lights, including solar glare and laser pointers;
- the production of smoke that reduces visibility;
- the use of drones in the vicinity of airports; and
- the presence of accumulated solid waste on which birds may feed or water elements that may be used during migration.

3.2.6 Land-use planning in the vicinity of an airport is twofold and it should provide:

- airport needs, e.g. obstacle limitation, future development; and
- minimal interference to the environment and public by utilizing the most compatible land.

3.2.7 Today probably the most significant factor influencing land-use planning in the vicinity of airports are noise and air pollution caused by aircraft operations and maintenance. Land on an airport or within its vicinity may be vulnerable to soil erosion by natural elements and, to a limited degree, by aircraft jet blast. This problem can mostly be prevented by replanting; however, in arid areas it may be necessary to take artificial erosion protection measures, such as facing of escarpments, paving of taxiway shoulders and lining of drains. The utilization of land for airport purposes can also cause disturbances to flora and fauna. Airport development work frequently entails clearing and cutting back of trees and other vegetation, changes to the topography of the area, and interference with watershed patterns. Thus, airports may destroy

the natural habitat and feeding grounds of wildlife and may deplete certain flora that is vital to the ecological balance of the area. There are also potential impacts on human beings. Such impacts are typically captured in environmental impact assessments to be carried out at the airport planning phase and used as a basis for adopting actions aimed at limited the impact of the new infrastructure and its operations on the environment.

3.2.8 As far as these environmental problems are concerned, airport construction is not significantly different from any large construction site. In many countries, the issue is governed by general legislation on planning and development of construction sites.

3.2.9 As stated in 3.2.4, a systematic approach for identifying the environmental effects of proposed project should be provided to minimize or eliminate potential adverse influence on environment. A level one matrix should be used to identify the interaction between activities and general categories of environmental components involved. The identification of possible impact points is followed by an impact analysis.

3.2.10 An environmental impact assessment process should include project description, environmental description, project/environment interaction analysis and its impact, and monitoring program. A final report should be prepared which details all the phases and results of the environmental assessment. The environmental impact assessment report must be clear, concise and suitable for public scrutiny, if required. The environmental impact assessment report should contain the details that are needed to make informed decisions with respect to the environment. This is achieved by:

- identifying all project components for the purpose of refining the scope of the project and the scope of the environmental assessment;
- carrying out a detailed and organized environmental screening of the project based on specific terms of reference and any approved modification/additions; and
- Presenting the process and results in a screening report suitable for public scrutiny and decision making.

3.3 The Interface Between Airports and Urban Areas under SDGs

3.3.1 From the early 20th century, the aviation industry has grown to meet the needs for efficient rapid travel. Air transport has become a crucial segment of human transport in the 21st century, more so in influencing human activities such as urban forms, settlement patterns and economic activity. To support the ever-growing need for air travel, aviation infrastructure has been undergoing changes in equal measure to accommodate the growing global demand for connectivity and mobility. Airports have evolved from simple grassy and gravel airfields to elaborate airport cities (aerotropolises); with large scale airport infrastructure to handle passenger and cargo traffic, and their attendant aviation services as well as non-aviation related undertakings, such as conference centres. Modern airports have a complex mesh of land uses to support aviation activities and services, and other associated needs.

3.3.2 Airports have important bearings on planning around and beyond the city and region of location. Airports are located in close proximities to major cities or other major land uses such as tourism sites and major economic zones; to offer faster and convenient travel modes to the users of other land uses in the proximity of the airport. Some airports have been designed to serve as regional and global air transport hubs to support the transfer of passengers, goods and services from one flight to another and intermodal transfer. On another hand, cities are beginning to develop around airports. This development includes not just hotels and restaurants, but also, more importantly, transport-focused or transport-dependent businesses. "City airports are becoming "airport cities. The Sustainable Development Goals (SDGs) were affirmed in September 2015 during the 2015 UN General Assembly as a universal normative development blueprint for all members ascribed to the UN charter. Of the 17 SDGs, goal number 11 is wholly dedicated to ‘Sustainable Cities and Communities- Making cities

and human settlements inclusive, safe, resilient and sustainable'. This 'urban' goal has ten attendant targets that refine the focus on key areas that need urgent attention in addressing urbanization challenges worldwide; where policy makers assert that the battle for sustainability will be won or lost in cities.

3.3.3 In the formulation of the SDGs, the drafters noted that sustainable urban development and management are vital in the quality life of people living on the planet. It was thus prudent to include an urban goal in the Post 2015 Development Agenda so that a clear framework was provided to engage local authorities and all communities in the sustainable management of their settlements (World Bank, 2014). Due to the emerging crucial role of urbanization; more especially in the developing world, sound management of urbanization will be a key tool to tackle negative impacts of development and promote sustainability in human settlements thus ultimately tackling climate change (United Nations, 2015).

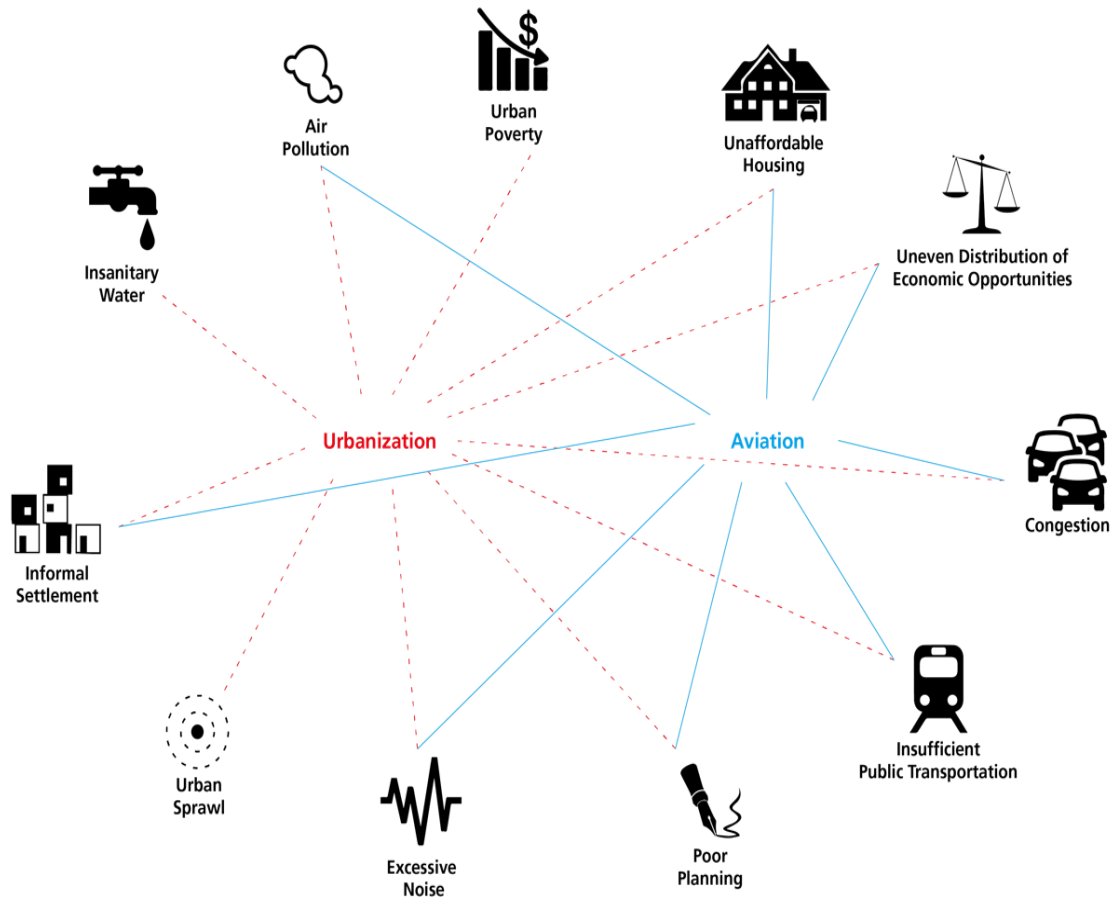
3.3.4 ICAO has mapped its current Strategic Objectives for global civil aviation against 15 of the 17 Sustainable Development Goals which comprise the 2030 Agenda. The total economic impact of aviation reaches some 3.5 per cent of GDP or 2.4 trillion US dollars and the employment of 58.1 million people, because of its cross-cutting nature and multiple links to other economic sectors. This authenticates that aviation generates sustainable prosperity and transforms lives.

3.3.5 The proximity of airports to major cities throughout the world has led to the creation of development corridors between the airport facilities and the core city and beyond as a means to facilitate movement of people, goods and services between the two places. The links from airports to other land uses create other centres and activity areas along development lines in a city, creating different levels of activity. These links result in different levels of interdependencies and interrelationships; that affect the kind and level of activities and settlements in different areas of the city.

3.3.6 Airport infrastructure is a key landmark, and land use in the city and its region can be used as a nodal point to streamline and manage other land use activities around it. This concept also includes the development corridor to the core city and towards the rural interphase adjacent to the city. It is a crucial link in connecting people to opportunity at, and beyond the local level; and for integration of societies.

3.3.7 The successful relation of land uses inter-phasing airports and urban areas is a critical link in creating growth synergies along the corridors connecting airports to other land uses and is a key factor in informing land use planning in urban areas. The relationship between these corridor facilities connecting different areas of socioeconomic growth, as well as their impacts on the environment, should be managed well for sustainable urban growth.

Figure 10: Relations between aviation and urban growth



©Runze, 2016, Source: UPP data extracted from United Nations Environment Programme. Global Environment Outlook, GEO Data Portal, Human Development Index (HDI) (2010)

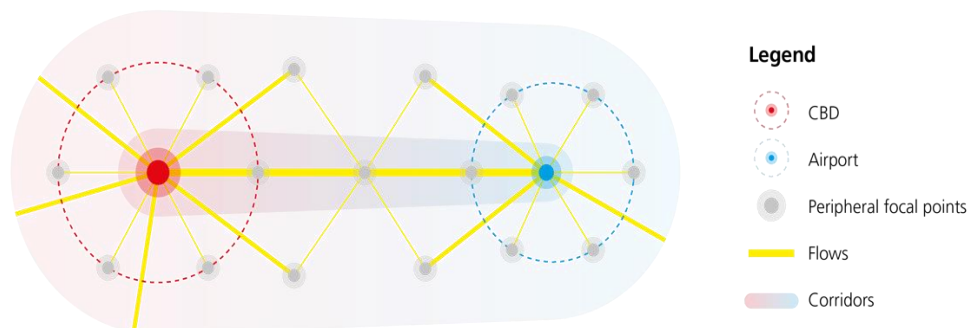
CHAPTER 4: AIRPORTS AND URBAN MOBILITY

4.1 City-Airport Connectivity: The City-Airport Transport Corridor

4.1.1 In urban and regional planning, transportation takes up one of the largest proportions of land use allocation; due to the extensive web of transport networks permeating the city such as airports, roads, cycle paths, railways, metros, cable ways and pedestrian footpaths. Thus, airports have been key development nodes in planning urban areas, and have a unique eventual role in facilitating movement and distribution systems towards the urban and regional planning framework. There is a strong correlation between airports and the development of metropolitan areas. In the early development of airports, they were often built outside the urban area, however as communities increase by growth, they are now encroaching upon airports which requires effective land use planning between the airports and communities, as per ICAO Doc 9184 Airport Planning Manual Part 2, Land-Use and Environmental Management.

4.1.2 Airport hubs create nodal points in a city region. They are connected to the city and the rural area using transport corridors routes to facilitate circulation of goods and services. Consequently, there are other transportation links from other areas such as the CBD and rural hinterlands of the city to connect the airport. Such links can be roads, railways or waterways. The transport links realized forms a crucial circulation factor that is used to facilitate movement of goods, people and services between other land uses in a local area and the airport. The resultant transportation factor can be utilized to boost economic growth and development along the corridor routes and the neighbouring urban area.

Figure 11: Transport Corridors in Metropolitan Development



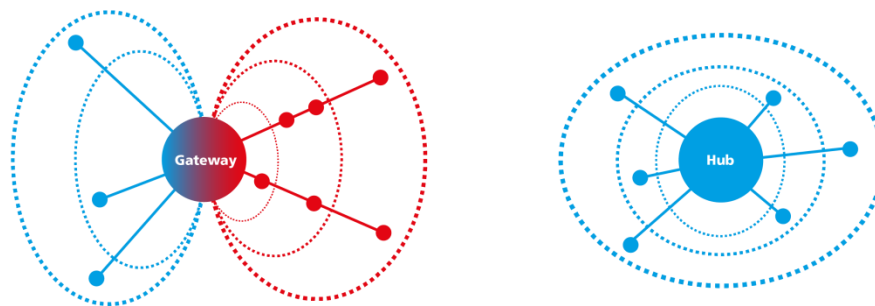
©Runze, 2016, Source: Adapted from Rodriguez, J.P (2007) Gateways, Corridors and Global Freight Distribution: Transpacific Issues

4.1.3 Airports are crucial planning tools in cities and regions that can inform the development character and other development options that can be exploited to enhance economic output and promote prosperity in cities, regions and countries. Development policies based on transit oriented development models applied to airport development and urban development are crucial determinants in the level of economic activity and the spread of the value of goods and services associated with the use of airport facilities.

4.1.4 Airports are gateways to other countries and regions because they promote continuous circulation of goods and services to service supply and distribution chains. Airports encompasses the terminal, other facilities such as warehouses, distribution centres, banking facilities, hospitality facilities and other compatible industries that are located in or near airports, forming part of its

ecosystem. These in totality facilitate entry and exit of goods, services and people from the catchment area of the airport to other locations. They also form hubs by virtue of their location and transport role. They collect, sort, trans-ship and distribute passengers, goods and services

Figure 12: Airports as Gateways and Hubs



©Runze, 2016, Source: Rodriguez, J.P (2007) Gateways, Corridors and Global Freight Distribution: Transpacific Issues

4.1.5 Transport is an indispensable tool in facilitating the creation of a single socio-economic space that would lead to free movement of goods and persons around the world. Integrated transport system ensures the link from/to air transportation to other modes of transport for seamless movement of passengers and cargo.

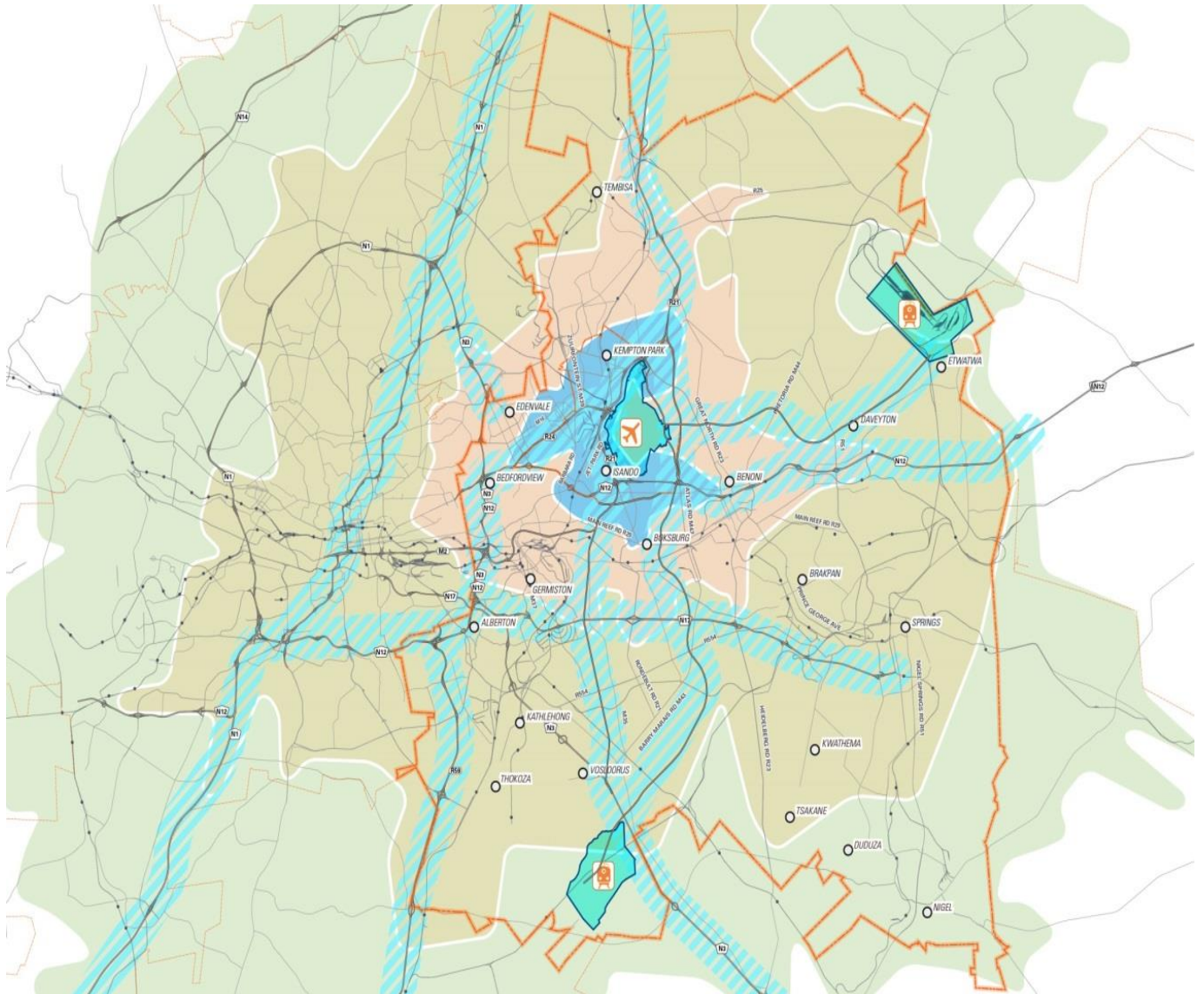
4.1.6 For transport to play its full role and have an effective impact on sustainable development, there is a need for physical integration of networks; operational integration; user-service provider interface; convergence of policies; joint planning and development of transport facilities and systems; harmonization of standards in each mode and seamless operation with others; and joint cross-border investments.

4.1.7 The city-airport corridor forms a crucial economic link due to the value created by the land users accessing the city and the airport. The economic opportunities happening along this corridor can be amplified to ensure that the city makes a maximum gain of the corridor through reticulation of services and infrastructure to spread the benefits of the transport corridor. This is best done using link roads and other related corridor infrastructure such as water, sanitation, power and fibre-optic.

4.1.8 The created corridor becomes a suitable location for land users such as residential users, commercial establishments, warehousing and storage activities, educational activities and recreational functions. These are however regulated by city authorities to ensure maximum replication and addition of value of properties.

4.1.9 Regulation happens through land use regulation and development control mechanisms defined by city authorities. For OR Tambo Airport, this is done through the Ekurhuleni Town Planning Scheme of 2014,

Map 13: Transport Corridors around ORTIA



Source: Ekurhuleni Metropolitan Municipality

Figure 13: Gautrain Link to ORTIA



Source : Ekurulheni Metropolitan Municipality

4.2 Air Transport Users' Facilitation

Air passengers' expectations include rapid and direct transfer from the city centre to the airport and vice-versa, easy connection between airport terminals when transiting, quick and convenient transfer of passengers and their baggage between air/surface transportation, as well as availability of specialized services in multimodal terminals and provision of special services for persons with reduced mobility. The use of multi modal transportation reduces the environmental effects from greenhouse gases and local air quality. It also encourages the usage of corridors which will reduce the impact on land use. Corridor planning is being promoted globally by governments to reduce land use, and to permit efficiency of infrastructure, ie: roads, pipelines, electrical.

Cargo operators expect a quick turnaround in handling goods passing through airports, quick and convenient links to markets and storage facilities, and faster clearance processes in airports for entry and exit of goods.

4.2.1 Passengers, Meeters and Greeters Facilitation

4.2.1.1 Urban mobility affects the facilitation of air passengers, cargo and mail deliveries, as well as meeters and greeters. Metropolitan authorities should structure urban transport mobility system including multimodal connectivity to accelerate the flow of traffic from and to the airport. The provision of an excellent public transport system may be outside the scope of the airport authority, but there is the possibility of encouraging airport employees to use public transport. Provision can be made for inter-modal interchange facilities in the layout planning and design of new airports and in the extensions of existing infrastructure, particularly terminals. Passengers may be provided linkage to light, conventional or high-speed rail systems as well as regional and local bus facilities, the latter being particularly appropriate for employee access. The provision of such facilities should go hand in

hand with the development of an airport public transport strategy appropriate to local conditions and consistent with a policy of cooperation with transport providers. Airports should coordinate with municipalities to ensure convenient inter-modal transport is considered in municipal plans.

4.2.1.2 Surface and air transport connection between surface and air transport exists though there is a need for more access to the airport and connection between terminals at specific airports. Surface public transport should be scheduled with timetables for effective connectivity to improve facilitation. Environmentally friendly transportation including public transit, alternative fuelled vehicles and hybrids should be encouraged by airports and communities. The reduction of congestion in the urban surface transport network could make the mobility predictable and provide certainty in journey planning to the airport and forwarding perishable air cargo to arrive timely at adapted warehouse or any storage facilities at the airport.

4.2.2 Access to Study Airports

4.2.2.1 Access to **Addis Ababa Bole International Airport** has been determined adequate. There are four access points to the passenger terminals, and two to the air cargo terminals. The road traffic flow is prearranged to facilitate deviations or rerouting in case of foreseen circumstances which may lead to congestion or road accidents and a prearrangement strategy could be applied to unforeseen circumstances, if required. The airport is served by the public transport despite that it is not well coordinated in terms of interconnectivity and that is not time based (no schedule). The public transport is complemented by rent a car service, hotel and tour operator shuttles. The traffics of surface transport is stable, metropolitan authorities are required to plan the years ahead as car fleet is constantly increasing in the city. Approximately 85% of airport users come to the airport by public transport. It is planned that the airport will be connected by train. There is no one ticket journey connecting air to surface transport and vice-versa.

4.2.2.2 Urban mobility from and to the **Jomo Kenyatta International and Wilson Airports** is affected by the low level of facilitation of air passengers, cargo and mail deliveries as well as meeters and greeters. Metropolitan authorities need to restructure urban transport mobility system including multimodal connectivity to accelerate the flow of traffic. The acceleration of operationalization of the ongoing plan for the development the multimodal connectivity is of capital importance.

4.2.2.3 The number of cars is increasing in Nairobi, however, the infrastructure is not following suit. This result in the delay of passengers leading to increase no shows, and late report of staff to duty stations, which affects the quality of service. Cooperation between stakeholders dealing with FAL should be enhanced. Incentives for public transport would be beneficial both for passengers and employees. Indeed, the Airport Planning Manual, Part 2 indicates that: “A logical and efficient layout for both local and arterial traffic will be needed to maximize throughput for arrival and departure areas and other activity on and near the airport. Minimizing driving, congestion and idling time on the airport access roads will also benefit the local air quality in the vicinity of the airport.”

4.2.2.4 No survey has so far been carried out with regard to the use of city public transport by the travelling public. However, it is roughly estimated to 80%. There is no regular public surface transport system linking the Jomo Kenyatta International and Wilson Airports.

4.2.2.5 The level of public transport services is very low around **OR Tambo International Airport** **although infrastructure** provides capacity to increase such service as the city experiences road traffic congestion during morning and afternoon peak hours. Intermodal public transport links can include local and regional bus stations, local and regional (light and heavy) rail stations and ferry terminals built to allow easy transfers for airport passengers. Such facilities are important for emissions reduction, and the long-term sustainability of an airport and the areas they serve. Clearly during the planning stages of an airport development, the airport developer needs to participate in regional planning to ensure that the airport is integrated into the regional (and national) transport plan. This

would reduce the cost and time of journey of the traveling public, as well as the impact on the environment. The planning is to move from private to public transport which is more safe, efficient and clean. The current situation at OR International Airport is similar to **Lanseria International Airport**.

Figure 14: Multimodal Transport Connections to ORTIA



Source: Ekurhuleni Metropolitan Municipality

Ekurhuleni Metro is currently constructing a Bus Rapid Transit System from the North of the City directly to the airport. Currently, only 10% of airports users travel by public transport. OR Tambo has 16,000 parking lots that further compound the transportation problem; private car owners prefer to drive and park at the airport till their journey ends. The parking lots however contribute to the non-aeronautical revenue. Facilities could be provided to encourage the use of alternative-fuelled vehicles such as priority assigned spaces for hybrid and electric vehicles (EV) and EV charging stations. Since EV charging technologies are evolving, airports can pursue demonstration projects with start-ups. Technology such as green lights above vacant parking spaces can be used to assist parking and reduce traffic circulating in search of spaces.

4.2.3 Freight facilitation and logistic chain

4.2.3.1 Contracting States shall consult necessary and adopt regulations and procedures with all involved parties to increase efficiency and economies of the air transport mode. The regulations and procedures should also be applied to cargo moving by both air and surface transport. Recommended practice is establishing free zones and/or customs warehouses which might be developed and operated by a Contracting State or other parties. Detailed regulations as to the types of operations allowed to perform therein should be published. To enhance security, it is recommended to consider the introduction of programmes for Authorized Economics Operators. All procedures and documents should be simple and Contracting States should be participating in the development of electronic air cargo community systems.

4.2.3.2 The goal of regulations for dangerous goods transport is to provide safe and efficient air operations. Investigation has shown that often when accidents involving dangerous goods have

occurred, they did not meet the current legal requirements. Necessary to provide all participants (those who organize and provide transport and government who oversee this activities) to have a comprehensive working knowledge of the requirements of the requirements laid out in ICAO Technical Instructions. The safety level is always equivalent to the level of safety provided in this instruction.

4.2.3.3 Each Contracting State shall take the necessary measures to achieve compliance with the detailed provisions and take the necessary measures to achieve compliance with any amendment to the Technical Instructions. It is recommended to inform ICAO of difficulties encountered in the application of the Technical Instructions and of any amendments which would be desirable. Where a Contracting State adopts different provisions from those specified in the Technical Instructions, it shall notify ICAO promptly of such State variations for publication in the Technical Instructions. Each Contracting State shall designate and specify to ICAO an appropriate authority within its administration to be responsible for ensuring compliance with Annex 18.

4.2.3.4 It is important to note that some dangerous goods are forbidden for transport by air, and those which are allowed must be prepared and transported under special procedures. Important issuance must be placed on dangerous goods transport is the packaging and separation of packages. Packaging shall be of good quality, constructed and securely closed so as to prevent any leakage and contamination. Each package of dangerous goods shall be marked with the proper shipping name of its contents and, when assigned, the UN number and such other markings as may be specified in Technical Instructions. It is recommended to use English in addition to the languages required by the State of Origin. To provide safe transport of dangerous goods by air it is required:

- to provide all necessary documents,
- to inspect package, over pack or freight container containing the dangerous with the acceptance procedures contained in the Technical Instructions,
- remove any hazardous contamination without any delay.
- an airport environmental emergency plan should be established which outlines the procedures to follow in the case of an accidental spill or release of hazardous substance. The steps of the plan should follow the securing of the hazard; the approach to be taken in response; the identification of the substance in accordance the United Nations Product Identification Number (PIN); the assess of the situation; and, the appropriate response to ensure safety of responders and the public. Command, communication and coordination are the pillars of effective environmental emergency response to minimize the effects to life, property and the environment.

4.2.3.5 All participants of dangerous goods transport shall act according to ICAO Technical Instructions which will provide necessary procedures and detailed information.

4.2.4 Dangerous Goods Management

4.2.4.1 A mechanism exists to assess road transporters, forwarders and shippers of cargo through **Addis Ababa Bole International Airport** including dangerous and perishable goods for connection to airport or vice-versa. Ethiopian Civil Aviation Authority licenses transport companies transferring dangerous goods to and from the airport.

4.2.4.2 **KCAA** collaborates with concerned stakeholders in the cargo supply chain such as customs, health and trade Authorities to maintaining the key air cargo requirements of safety, security, speed and quality. Efficiency in the cargo supply chain is achieved when restrictions on the smooth flow of cargo are alleviated which usually comes from regulatory bodies.

4.2.4.3 National standards on the transport of dangerous goods on multimodal surface transport system are strictly implemented at **OR Tambo and Lanseria International Airports** in addition to

SARPs. These standards are applied to all dangerous goods transferred to the airport. At the airport level, these dangerous goods are screened to certify their compliance with ICAO requirements before any processing as air cargo. Fuel is delivered at OR Tambo International Airport by train and pipeline while at Lanseria International Airport the delivery is by road, in accordance with applicable legislation and regulations. Relevant regulations aimed at regulating the movement and storage of dangerous goods are applied in both Ekurhuleni and Johannesburg Metros.

4.2.5 Public Health – Vector Control

4.2.5.1 Vector control involves taking control measures (such as spraying, trapping etc.) against vectors, which International Health Regulations define as “an insect or other animal which normally transports an infectious agent that constitutes a public health risk” with the aim of keeping the vector density below the threshold level set by national policies and practices. ICAO contributes in developing a centralized register to share information between airports and States concerning specific airport vector control measures in place which assist States in their risk assessment.

4.2.5.2 Airport vector control involves taking control measures with the aim of keeping a vector free area within the 400 meters airport perimeter as stated in the IHR. Standard WHO recommendations regarding airport vector control should be implemented in keeping with the IHR 2005. The latest WHO guidance recommends that States should strengthen awareness of the importance of vector control measures and improve consistency of disinfection practices. However, disinfection policies are dependent on individual State risk assessment. In practical terms, States would need to base their risk assessments on the probability of infected persons entering the State, the presence of mosquito vectors at departure airports as well as in the State of entry and the probability of importation of mosquito vectors between States. ICAO developed an Airport Vector Control Register to facilitate the sharing and dissemination of importation of mosquito vectors between States. It consists of a web-based, access controlled survey that is designed to facilitate sharing of airport vector control practices. The information contained in the Vector Control.

4.2.5.3 Registration will be made available to States and airports, as well as the public in a secure manner with different levels of access, appropriate to the relevant party. The public will have access to a page that identifies only the airports that have reported their vector control measures (without providing any details of the measures themselves). Airports with verified credentials (through the vector control register website) will have the ability to view the measures implemented by other airports as a means to benchmark their vector control methods (access only to statistical analysis and not airport-specific information). States will be able to access the specific vector control measures in place at individual airports (as reported in questionnaire responses) as an additional source of information to review their risk assessments. The completion of the airport vector control survey is strongly recommended. Thus, States are urged to encourage their airports to contribute to this Register. A measured approach to airport vector control practices will promote awareness of infectious disease outbreaks, within the aviation community; encourage an appropriate and consistent approach to disinfection; reduce unnecessary costs to operators; and improve the operational efficiency at airports.

4.2.5.4 WHO shall publish, on a regular basis, a list of areas where disinfection or other vector control measures are recommended for conveyances arriving from these areas. Every conveyance leaving a point of entry situated in an area where vector control is recommended should be disinfected and kept free of vectors. When there are methods and materials advised by the Organization for these procedures, these should be employed. The presence of vectors on board conveyances and the control measures used to eradicate them shall be included:

- a) in the case of aircraft, in the Health Part of the Aircraft General Declaration, unless this part of the Declaration is waived by the competent authority at the airport of arrival; and
- b) in the case of other conveyances, on a written proof of treatment issued to the consignor, the consignee, carrier, and the person in charge of the conveyance or their agent respectively.

4.2.5.5 States should accept disinfecting, derating and other control measures for conveyances applied by other States if methods and materials advised by the Organization have been applied. States shall establish programmes to control vectors that may transport an infectious agent that constitutes a public health risk to a minimum distance of 400 metres from those areas of point of entry facilities that are used for operations involving travellers, conveyances, containers, cargo and postal parcels, with extension of the minimum distance if vectors with a greater range are present.

4.2.5.6 A State should not prohibit the landing of an aircraft or berthing of a ship in its territory if the control measures provided for in paragraph 3 of this annex or otherwise recommended by the Organization are applied. However, aircraft or ships coming from an affected area may be required to land at airports or divert to another port specified by the State Party for that purpose.

4.2.5.7 A State Party may apply vector control measures to a conveyance arriving from an area affected by a vector-borne disease if the vectors for the foregoing disease are present in its territory within five years, all the State Parties must develop core capacities and infrastructure to designate airports and ports that shall develop core capacities requirements and may also designate ground crossings where justified for public health reasons.

4.2.5.8 Various physical, chemical, biological, mechanical, and environmental methods of vector control are known and many of these have been highlighted with the help of photographs in the text and annexes. Material required in surveillance programmes has been listed, as have different techniques recommended for disinfection of aircraft.

4.2.5.9 Finally annexes have been included to serve as a guide on situation-specific integrated vector management, including examples of potential mosquito breeding sites observed at points of entry and physical/minor engineering methods of intervention, surveillance methods for conveyances, containers, cargo, postal parcels and baggage, requirements of a site laboratory, preservation and transportation of specimens to a referral laboratory, methods of pathogen detection, on-site record forms for vector surveillance and control, statistical tables for vector surveillance, and physical methods of vector control used by entities stationed in ports. Guidance is also provided in the Airport Services Manual, Part 3 – Wildlife Control and Reduction – Doc 9137, the Airport Planning Manual, Part 2 , Land Use and Environmental Management, and should be part of both the airport environmental emergency plan and the airport environmental management system. All airport measures should be in accordance with local and State requirements governing the management of vectors.

4.2.6 Public Health - Pandemics

The transboundary access that airports permit also has seen the catalyst for transmittable diseases to be spread globally. The SARS epidemic in 2003 and the recent Ebola crisis has resulted in the development of specific airport procedures to control and contain the transmission of the deadly disease. As the world is further developed, and the population is able to travel to many destinations, it is important to ensure that measures are in place at the airport and affected communities to effectively deal with any potential pandemic. This requires the leadership and expertise from the World Health Organization, State authorities, urban and regional authorities, and those of airports. Agreed upon emergency plans and procedures should be in place in order to deal with any potential health concern. These plan need to be tested on a regular basis between all lead officials, the community, health officials including hospitals and medical professionals, and the airport community. Study Airports – Pandemics

The airport facilitation programme at Addis Ababa Bole International Airport is organized in accordance with international requirements. Matters concerning pandemic are the responsibility of the

Ministry of Health. The Ministry of Health performs its activities at the airport in coordination with the ECAA. The Ministry of Health is the only organization entrusted to communicate any prevailing situation in Ethiopia to the World Health Organization while ECAA is mandated to inform the international civil aviation community through publication in AIP. ECAA also informs all airlines operating from and to Ethiopia.

4.2.6.1 Technology for entry screening and quarantine space are available in all arrival terminals. The health control service works around the clock. The country has a national pandemic plan. Specific hospitals have been identified in city to receive suspected passengers. Emergency exercises are done every two years and concerned personnel are trained or re-trained systematically. Due to its multi-sectorial dimension, emergency situations related to pandemic are managed at State level. Exit screening is not very clear yet, hence the necessity to update the national emergency plan. The country is not experiencing shortage of medical professionals. It provides assistance to other countries in terms of health practitioners and supplies.

4.2.6.2 A programme for transmissible diseases by all concerned stakeholders exists in Kenya. A pandemic could be easily contained at the airport or at the city level. It is recognized that in most cases these health-related shortcomings start from the city. An interface framework between the airport and the city as well as between two airports through the National Public Health Emergency Programme is in place. An emergency exercise on contention and control of pandemic is organized on a regular basis.

4.2.6.3 South Africa has an established framework to contain pandemics from foreign countries at the airport and implemented at **OR Tambo and Lanseria International Airports**. The framework is in line with the Annex 9 to the Convention on International Civil Aviation supplemented by the guidelines of the Institute of Communicable Disease. All health-related matters are of the responsibility of the Department of Health.

4.2.6.4 The entry screening system is in place and has a proven response capacity in case of public health event originated from a foreign country. A new system to strengthen exit screening is at the design stage. For both entry and exit screenings, proposals are under consideration whether other members of the National Aviation Security Committee (NASC) could be trained and, a joint effort strengthened in case of pandemic to maintain the capacity of airport in terms of passenger and air cargo flow.

4.2.6.5 The Department of Public Health is required to play its role within the aerotropolis. This will imply the reconfiguration of the airport zone as regard to the health control activities with the aerotropolis Master Plan proposing a “Medical City Africa” adjacent to OR Tambo International Airport. At the national level, the cooperation between the Department of Transport and the Department of health is being revisited. Consequently, an MOU between the Department of Transport and the Department of Health formalizing this cooperation is under negotiation.

4.2.7 Signage (City Way-finding)

4.2.7.1 Signs, signals and marks to indicate airport direction are among the challenges in most African cities. The experience repeats itself in the opposite direction whereby there are no signage guiding customers from the airport to city. In some airports, flyers are distributed mainly by hospitality and tourism services to promote their own businesses.

4.2.7.2 There is no visual guidance or electronic devices at the arrival terminals providing urban surface transport network which may include distance and time for the journey as it is the case in other regions. Cities in Eastern and Southern African Region are behind in terms of electronic mapping such

as GPS. This is exemplified by the five airports as part of this study.

4.2.8 Study Airports – Signage

4.2.8.1 There is no guidance on surface transport network for passengers installed in the arrival terminals of **Addis Ababa Bole International Airport** but information may be obtained on request at the information desk as well as from hotels, tour operators and travel agents with established offices at the arrival terminals. Some of them provide free booklets containing necessary information for the city. Dedicated parking lots are allocated to privileged customers, services and employees. The airport has developed a consultation framework with hotel and travel associations including taxi associations. The city already has adequate signage in all main roads guiding the public to the airport. There is a plan to increase the number of signage in secondary roads.

4.2.8.2 It has been noted that the City of Nairobi needs to improve the signage around the city and vicinity indicating the direction of the **Jomo Kenyatta International Airport** and **Wilson Airport**. The same situation is true at the arrival terminal of the airports.

4.2.8.3 Ekurhuleni and Johannesburg Metros have sufficient signage indicating direction towards **OR Tambo and Lanseria International Airports**. Information is available at the arrival terminals and in the Gauteng train station at OR Tambo International Airport for the metropolitan area. There are applications for electronic devices which include comprehensive information for visitors. The information on the aerotropolis is structured to ensure a coordinated approach. Lanseria International Airport does not have the same system of information to users at the arrivals terminal. However, guidance is provided at information booths and websites.

4.3 Role of Cities in Promoting Aviation

4.3.1 Provision of Public Infrastructure and Services

Municipal authorities have a role of providing basic services and infrastructure to the residents within their jurisdiction, as the roles of local authorities and national government are distributed within every country.

The provision of public infrastructure and services must be coordinated between the airport and the community it serves. The synergies between will promote sustainable development for the region, and can share in the benefits socially, economically, and environmentally. Master planning at the local, regional and state level should incorporate present and future airport development. It requires complementary planning guidelines which will ensure effective development of infrastructure. The implementation of the plans will control conflicting land use issues such as encroachment, leading to co-benefits for all parties. The Airport Planning Manual , 2 provides the guidance to ensuring effective land use planning and environmental management.

In Kenya, Ethiopia and South Africa, the city authorities of the five airports identified in this project, support airport infrastructure through legislation. This includes regulations on land use around the airport facilities, provision of security services through the metropolitan/city police/law enforcement service around the airport facilities, reticulation of roads, water and sanitation facilities, to access and egress around the airport facilities, traffic control and management around airport facilities, and solid waste management services to airport facilities.

4.3.2 Development and Implementation of City Level Legal and Policy Guidelines (Planning Laws, Regulations and Development Control around Airports)

City authorities have a legal mandate to make laws and regulations to govern their areas of jurisdiction. These laws and regulations are meant to improve land the socio-economic environment of the city, create value in land, make changes to and regulate land use, among other functions.

The Nairobi City county government, the City Council of Addis Ababa, Ekurhuleni Metropolitan Municipality and Johannesburg City Municipality have laws and regulations to control and regulate land uses around airport facilities, making airport zones controlled development zones within a city. The land use laws and regulations are enforced through stringent development controls measures that are engaged every time a development proposal is made in any airport zone.

Regulations are crucial for creating adequate ground clearance for landing and take-off, and safeguarding land users of land uses on the ground from harmful impacts of aviation uses such as noise pollution from aeroplanes, and mass casualties or destruction of property in the case of an accident.

In the wake of security breaches around airports and terrorism related attacks on airport facilities, safeguarding airport facilities in secure less congested land have been crucial in cities such as Nairobi, where a screening facility for all vehicles and people accessing the airport have been placed at the entrance of the airport. However, in almost all cases it was observed that in the city-airport relationship, most of the cities do not providing adequate incentives to the airports to motivate progress.

CHAPTER 5: ORIGIN AND DESTINATION CITIES AIR CONNECTIVITY

5.1 Impact of air service liberalization in Africa

5.1.1 The air transport sub-sector in Africa has not been fully developed. However, there exists great potential and untapped conducive conditions, which could enable the aviation industry to grow and develop in the continent. Africa's population size (1.1 billion) and large landmass (30.2 ml km²) presents a favourable environment for the air transport industry. The fact that almost a third of African countries (16 out of 54) are landlocked, and that the road and rail modes of transport are underdeveloped, permits air transport to be the most convenient and reliable transport sector. While these conditions are, seemingly favourable, one of the key reasons that have made commercial aviation in Africa the least developed in the world is excessive regulation, over taxation, and the lack of liberalisation of air services.

5.1.2 Efforts have been continued to liberalize the African air transport market since 1988, which resulted in the adoption of the Yamoussoukro Decision (YD) by Heads of States in the year 2000 to progressively open-air transport within the continent. This decision was expected to progressively eliminate all the non-physical barriers.

5.1.3 The Declaration on sustainable development of air transport in Africa adopted by a meeting organized by ICAO in Antananarivo, Madagascar, supports, among others, the implementation of the Yamoussoukro Decision towards the establishment of a single African air transport market to ensure that it converges with the worldwide regulatory framework in order to enhance seamless travel by facilitating the commercialization, liberalization and globalization of the international air transport.

5.1.4 Air cargo plays a vital role in the African economy, as roughly 35 per cent of global trade by value is transported by air and success of many economies and operations depends on rapid and reliable delivery of goods. Air cargo services are therefore a major contributor to the Continent's sustainable economic development. The strategic decisions taken in the framework of the Declaration on development of air cargo in Africa, to the ICAO in Lomé, Togo, should be implemented.

5.1.5 Thus, the impacts of liberalisation are extended beyond those to passengers. The increase in air services and traffic volumes stimulated by liberalisation has been found to increase employment and benefit the wider economy. This arises in a number of ways:

- a) **Aviation Sector:** additional economic activity in the aviation sector is generated by the servicing, management, and maintenance of the additional air services. This includes activities at airlines, airports, air navigation, and other businesses that support the aviation sector. The impact can "spin-off" into the wider economy (called indirect or multiplier impacts) — e.g., food wholesalers that supply food for catering on flights, trucking companies that move goods to and from the airport, refineries processing oil for jet fuel, etc.
- b) **Tourism Sector:** air service facilitates the arrival of larger numbers of tourists to a region or country. This includes business as well as leisure tourists. In addition, eco-tourism should be encouraged to avoid negative impact on environment. The spending of these tourists can support a wide range of tourism related businesses: hotels, restaurants, tour companies, theatres, car rentals, etc. Of course, air service also facilitates outbound tourism, which can be viewed as reducing the amount of money spent in an economy. However, even outbound tourism involves spending in the home economy on travel agents, taxis, etc. It is not necessarily the case that money spent by tourists flying abroad would be spent on tourism at home if there were no air service.
- c) **Impacts on Trade, Investment and Productivity:** also known as *Catalytic Impacts* or *Wider Economic Benefits*. These impacts relate to the way in which aviation facilitates the business of other sectors of the economy. Air transportation facilitates employment and economic development in the national and regional economy through increased trade, attracting new

businesses to the region, and encouraging investment. Industries and activities that would otherwise not exist in a region can be attracted by improved air transport connectivity.

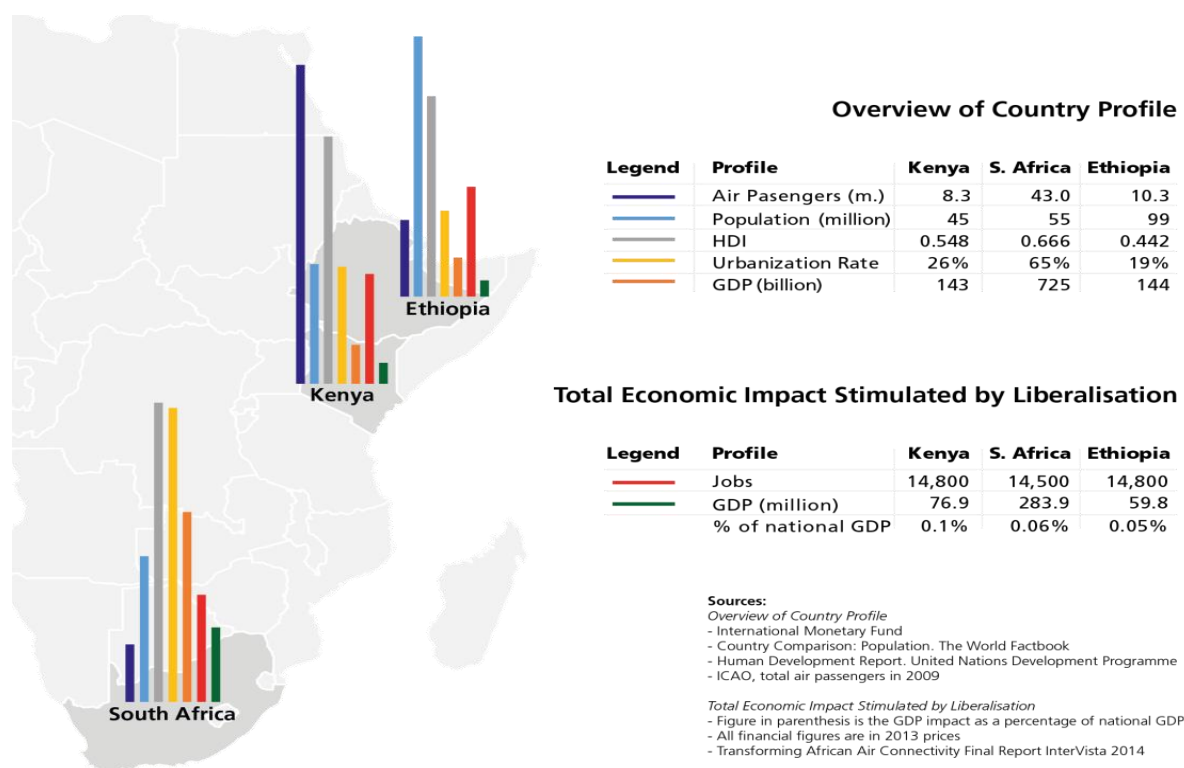
5.2 African Single Air Transport Market Towards Full Implementation of the Yamoussoukro Decision

5.2.1 During the 24th Ordinary Session of the AU Assembly, the Heads of State and Government took clear decisions to move forward concrete implementation of the AU Agenda 2063 Flagship project on the establishment of a Single African Air Transport Market through the Yamoussoukro Decision.

5.2.2 As an instrument of implementation, the Union Assembly established a Ministerial Working Group to oversee and guide implementation of agreed activities and road map for the establishment of a Single African Air Transport Market by 2017. The working group is composed by Ministers responsible for Air Transport of the eleven (11) countries which had declared their Solemn Commitment to the implementation of the Yamoussoukro Decision towards the establishment of a Single African Air Transport Market during the 24th Ordinary Session of the Union Assembly which took place on 30th and 31st January 2015 in Addis Ababa, Ethiopia. **Ethiopia, Kenya and South Africa** are among these countries. The number of African countries which have subscribed to the *Single African Air Transport Market* has increased to fourteen (14) countries as of 30 June 2016.

5.2.3 The Ministerial Working Group adopted a detailed road map of activities developed by the African Union Commission for the flagship project on establishment of a Single African Air Transport Market and endorsed by the 25th Ordinary Session of the Assembly in June 2015.

Map 14: Map of Total Economic Impact Stimulated by Liberalization



(Figure in parenthesis is the GDP impact as a percentage of national GDP. All financial figures are in 2013 prices.)

Source: Adapted from 'Transforming African Air Connectivity-Final Report-InterVista (2014)

CHAPTER 6: LAND-USE PLANNING

6.1 Background

City authorities have a legal mandate to make laws and regulations to govern their areas of jurisdiction. These laws and regulations are meant to improve the socio-economic environment of the city, create value in land, make changes to and regulate land use, with the view to minimize the impact of urban activities on the environment, among other functions.

The Airport Planning Manual – Part 2 – Land Use and Environmental Management, Doc 9184 “states that airport planning is an integral part of an area – wide comprehensive planning program. The location, size and configuration of the airport needs to be coordinated with patterns of residential, industrial, commercial, agricultural and other land uses of the area, taking into account the effects of the airport on people, flora, fauna, the atmosphere, water courses, air quality, soil pollution, rural areas(such as deserts) and other facets of the environment.

Within the comprehensive planning framework, airport development and operations should be coordinated with the planning, policies, and programs for the area where the airport is located and vice versa. In this way, the social and economic impact, along with the environmental effects of the airport, can be evaluated to ensure to the greatest extent possible that the airport environs are compatible with the airport and, conversely, that the physical development and use of the airport is compatible with the existing and proposed land use.

Appropriate planning and infrastructure decisions at airports help to facilitate good environmental management. By planning for intended growth and development, estimations can be made about the type and extent of potential future environmental impacts to allow for a more integrated approach to environmental management.

Land use planning and management is an effective mean to ensure that activities nearby airports are compatible with aviation. Its main goal is to minimize the population affected by aircraft noise by introducing land-use zoning around airports. Compatible land use planning and management is also a vital instrument in ensuring that the gains achieved by reduced noise of the latest generation of aircraft are not offset by encroachment and further residential development closer to airports”

The comprehensive planning framework is necessary to achieve the synergies between airports and communities towards sustainable development

6.2 Study Airports

6.2.1 Jomo Kenyatta International and Wilson Airports each have a master plan which is part of the Nairobi Integrated Urban Development Master Plan (NIUPLAN). KCAA, KAA and other major stakeholders are excluded in the implementation of master plan of respective airport.

6.2.2 Land use conflicts are mostly related to land encroachment and illegal allocations. KAA has had several court cases to repossess the land. KCAA has been supportive in the repossession of the land for the airports through the courts as well as in arbitrations. KCAA and KAA consult residents and land use associations of people living around the airport before taking any measure on specific issues.

6.2.3 The following activities are among these considered compatible to the land use within the airport zone: industry, agriculture, business (private hotels, store, shops and office space), tourism and trade. KCAA and KAA are in joint effort to ensure safe and secure land use activities are in place for the interest of the airports.

6.2.4 Developments around the airports are supported by effective legal and policy instruments, however, enforcement is weak. It is recognized that there is a good understanding between the City, KCAA and KAA as a result of consultations on aviation related matters leading to decisions thereof.

6.2.5 The adjacent land users' benefits from the airport are: opportunities for employment, business, trade, tourism, security, safety, transportation, health services, etc. There is somehow irregular airport land acquisition from the airport by other organizations or individuals leading often to compensation of wrong owners.

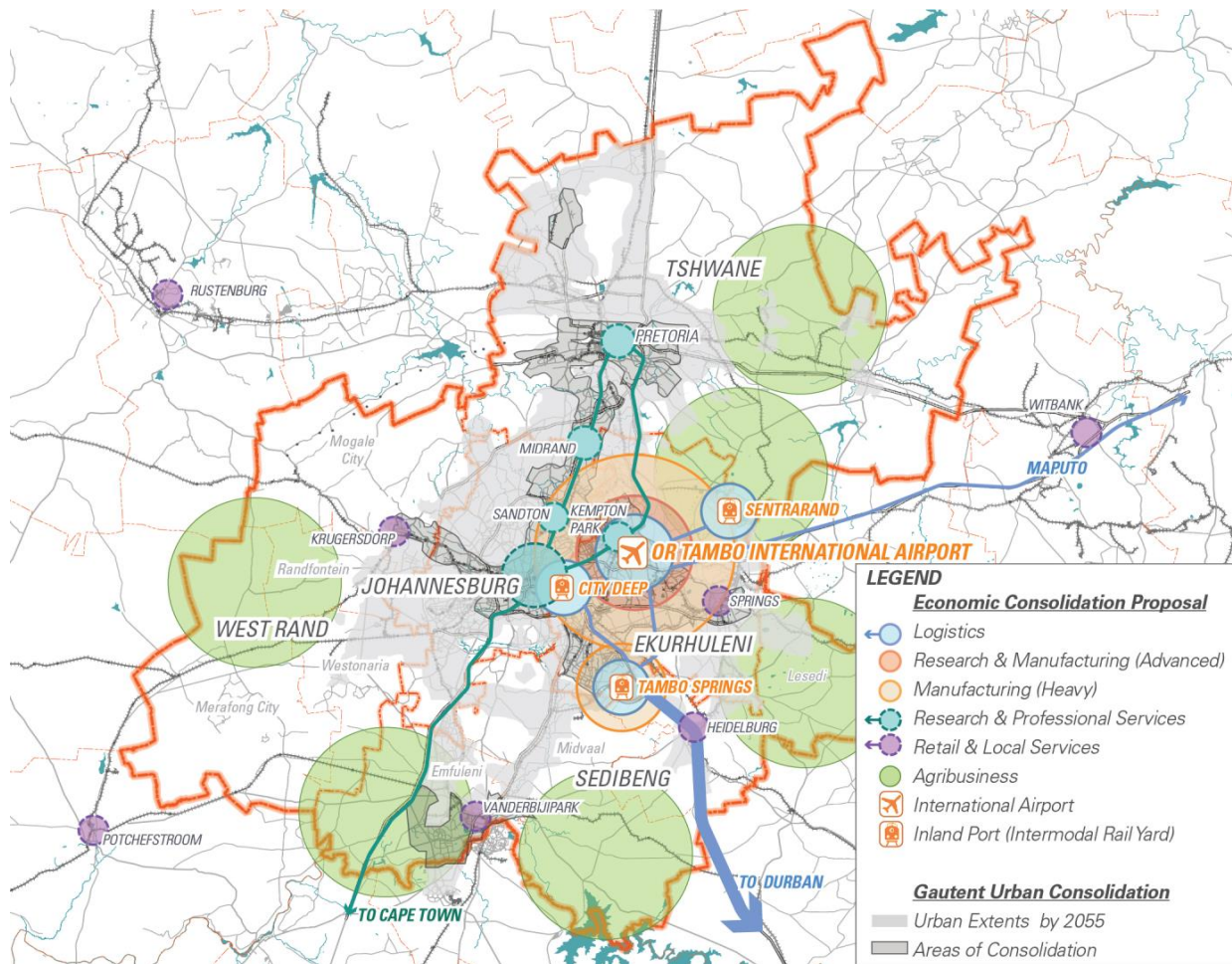
6.2.6 The airport has taken measures to ensure environmentally sustainable, resilient and adaptable urban development such as land use compatibility, new roads and railway for seamless systems between the city and the airports.

6.2.7 OR Tambo and Lanseria International Airports have implemented programmes on obstacle charting and identification. Building height in the vicinity of the airport and in the take-off and landing paths are regulated through height restrictions zone. New developments are compatible to the metro master plan. Airports are mostly located at the peri-urban land guided by Peri-Urban town planning scheme of 1975. This scheme is currently being used, but, will be replaced by Spatial Planning Land Use Management Act (SPLUMA) Act.No.16 of 2013. The National Environmental Management Act (No.107 of 1998) is always enforced through environmental impact assessment for any development proposed in or around the aerodrome. This is enforced through Environmental Management Framework as guided by Gauteng Department of Agriculture and Rural Development (GDARD).

6.2.8 OR Tambo International Airport is surrounded by zoning schemes such as Undetermined, Special, Private Open Space, and Industrial. Specific development projects should be advertised to avoid incompatible uses which can be defined through detailed socio-economic impact analysis and geotechnical studies. Planning regulations require comprehensive spatial development proposal. This is also to ensure inclusive public participation and awareness. Restricted land uses are permissive including agro-tourism related, conference centres, guest house, lodge, warehouse and resort.

6.2.9 Lanseria International Airport is also impacted upon by the Cradle for Human Kind which is a World Heritage site. This international tourist site is coordinated between the City of Johannesburg and Mogale City Municipality. Future development proposed for Lanseria in view of the aerotropolis includes: Mixed Land Use Planning and Development – Low, Medium, and High-Density housing project at Cosmo City and proposed Cradle City. There is also retail, commercial, offices and industrial corridor to tap into this.

Map 15: Land Uses around ORTIA



Source: Ekurhuleni Metropolitan Municipality

6.3 Zoning in the Airport Zone

6.3.1 An airport zone is at the centre for air traffic in the air transport system. Its vicinity is exposed on noise, air pollution and possible aircraft accidents. An increase in airport capacity usually involves changes to runway layouts, route structures, traffic distributions, infrastructure expansion, which in turn affect the risk and noise levels around the airport. Third party risk is an important issue in decision making on airport development. Major airport development plans, such as building additional runways, almost invariably involve government decision making and public inquiries. Therefore, the public’s perception of the local consequences of development is of paramount importance. The desired goal is for effective land-use planning and controls, based on objective criteria, such as noise maps, to minimize the amount of noise-sensitive development close to airports, while allowing for other productive uses of the land.

6.3.2 Various measures are available for controlling the use of land around airports. The effectiveness of these measures for both existing and new airports should be considered on a case-by-case basis. Based on a survey of land-use measures and policies in the countries reviewed, it can be stated that no single strategy prevails over other strategies in dealing with this issue. Overall, land-use control measures can be categorized as:

- Planning instruments (comprehensive planning and zoning ordinances, the

development of site specific noise contours, noise zoning, subdivision regulations, etc.);

- b) Mitigating instruments (building codes, noise insulation programmers, land acquisition and relocation etc.); and
- c) Financial instruments (capital improvements, tax incentives and noise-related airport charges).

6.3.3 At a minimum two zones should be established for the purpose of land-use planning to provide a compatibility airport matrix (Table 2). The zones should be developed in consultation between the airport and surrounding communities against a noise exposure scale. The land use measures should be strictly enforced to prevent any incompatible development in noise sensitive areas. In Zone A, due to high noise exposure level, all noise-sensitive land uses should be restricted and most developments prohibited. Within Zone B, moderate noise exposure levels may exist requiring the need to restrict land uses and development. The values of the noise exposure indices, corresponding to the noise zones adopted for land-use planning, should form a logical progression

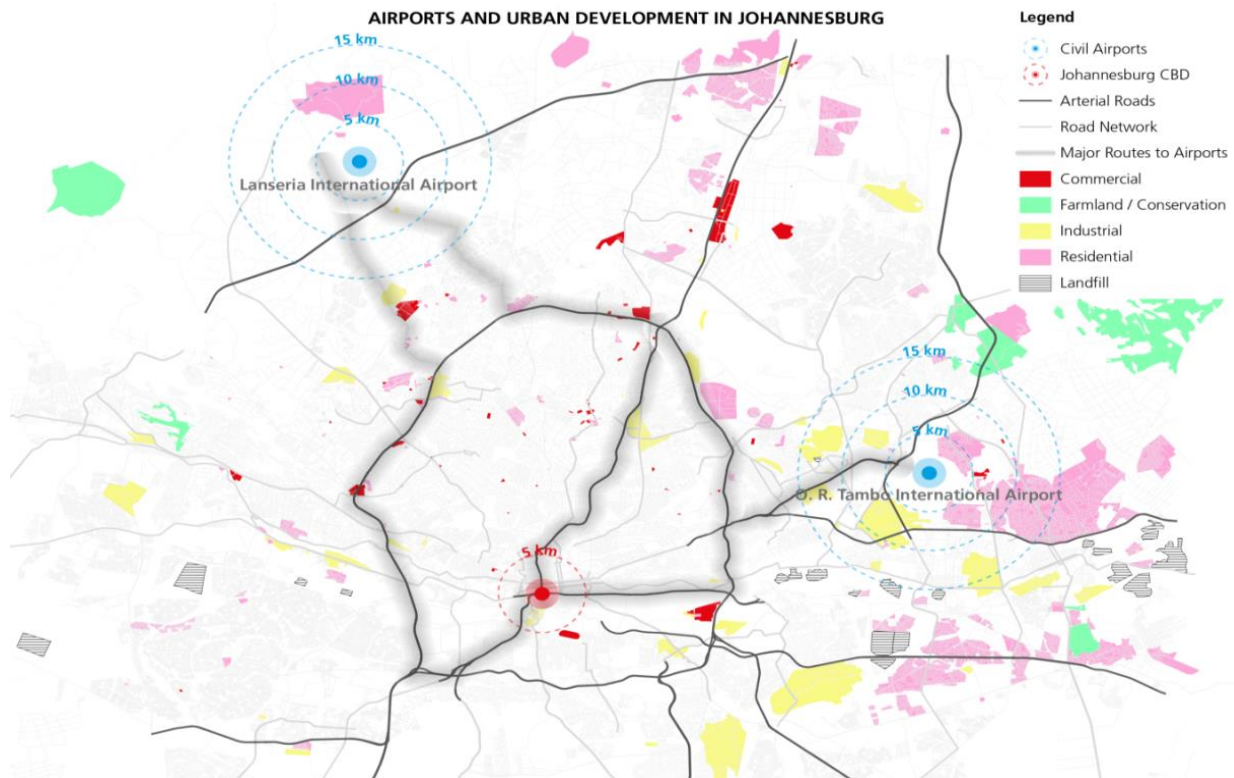
Table 2: Examples of compatible land uses around airports

Zones			
	A	B	OUTSIDE
Land-uses or developments	Most are not permitted	Some restriction	Unrestricted
Agricultural	Restricted or prohibited	unrestricted	
Industrial	Restricted or prohibited	unrestricted	
Commercial	Restricted	Unrestricted or restricted	
Residential	Restricted or prohibited	restricted	
Public facilities	restricted	restricted	

Source: ICAO

In relation to this topic, the Airport Planning Manual – Part 2, Land Use and Environmental Management states that “noise emissions generated on or in the vicinity of airports are unavoidable due to the nature of aircraft and ground operations. In 2001, the ICAO Assembly endorsed the concept of a “balanced approach” to aircraft noise management (Appendix C of Assembly Resolution A35-5) and subsequent ICAO Assembly Resolutions. This consists of identifying the noise problem at an airport and then analyzing the various measures available to reduce noise through the exploration of four principal elements, namely reduction at source (quieter aircraft), land use planning and management, noise abatement operational procedures and lastly operating restrictions.”

Figure 15: Airports in Johannesburg and Adjacent Land Uses



©Runze, 2016, Source : <http://lanseria.co.za/pages/gallery> (2015)

6.3.4 Privately owned land in the vicinity of an airport may be used for farming (with the restriction that this activity does not attract birds). Crop cultivation may however increase bird populations. It should also be noted that birds may be attracted to some pig farms where garbage is used as fodder. The agricultural use of land produces income from what might otherwise be vacant land. It provides crop cover and prevents soil erosion and eliminates the expense to the airport of mowing and maintenance. Furthermore, is still available for industrial or commercial development, recreational facilities, or public utilities at a later period.

6.3.5 The location of industrial sites at the airport or in the vicinity has generally been found to be compatible. However, it should be noted that industries that emit offensive noises, odours and smoke, create electronic interference or attract bird/wildlife should be restricted or prohibited within airport zones. Encouraging industrial development in airport areas can lead to important benefits. As a result of its location near the airport, these industries will usually become supporters of the airport and be interested in airport operations. In addition, airport owners and operators can derive a substantial income by selling or leasing the undeveloped land, or by developing the land and subsequently leasing or selling it to industrial firms. However, prospective sites for industrial development must still satisfy the following basic requirements:

- a) Desirable geographical location, considering the community in question;
- b) Availability of land of sufficient size to accommodate the planned industrial development;
- c) Access to commercial transportation facilities, in addition to air transportation, if necessary;
- d) Present and/or future availability of needed utilities;
- e) Access to nearby residential areas for the industrial employees, with reasonable commuting time; and) compatibility of proposed industrial development with other

area land uses.

6.3.6 Municipal utility in the airport area has proven to be economical and wise unless they create a smoke problem or attract birds. Special attention should be given to water resources within an airport environment to minimize impacts on both human and natural systems. Water supply is a necessity for the airport. For land use, consideration must be given to the various water resources in the vicinity of the airport. Water resources include surface water, groundwater, floodplains, wetlands, and special water features like underground aquifers or wells.

6.3.7 Such water sources require desalination. Brine solutions generated from water desalination must be evaporated for salt production. Land should be acquired for this. Treated waste water must be used to green the sand and loamy soils surrounding many airports. Buried drainage systems for irrigating those areas can reduce water evaporation and prevent foul smells. For desalination, if the airport has a water desalination plant, the concentrated saline solution generated should be treated as waste matter. The treatment and disposal of this waste should be considered during the planning phase of the airport facilities. Likewise, attention should be given to any change in the ecosystem of desert areas.

6.3.8 Deserts are particularly fragile ecosystems. Specific attention should be directed to the loss of natural plants upon which animals feed. In addition, electrical plants and power lines could be considered an obstruction by many airport planners. Power plants and other industrial uses that emit a hot exhaust plume can create turbulence problems and should be sited so the plume is not in the aircraft flight pattern.” Additionally, solar photovoltaic arrays should be appropriately sited in order not to create glint and glare that affects pilots, and personnel in air traffic control towers.

6.3.9 Highway or railway systems near an airport or connected with an airport must be coordinated with airport officials to incorporate their circulations elements appropriately if beneath the approach and climb-out paths. This is acceptable if all potential obstacles (e.g., high vehicles, road lighting) are avoided and designated safety zones are maintained to achieve maximum safety and environmental benefit. Highway and railway construction are, in general, a more preferred land use near airports than residential housing, which would be adversely affected by noise and emissions. Areas adjacent to the road or rail network can be more easily adapted to commercial, industrial, and recreational uses. The development of road and rail, as well as commercial services, near an airport can be an effective way to prevent residential housing from developing in critical noise areas.

6.3.10 Noise and public hazard are marginal problems for many types of recreational activities (e.g., playgrounds, athletic fields). The potential risk of an aircraft accident and its effects should be considered when planning activities where large groups of people are involved.

6.3.11 Tennis courts and golf courses, if located under approach areas to a busy airport, should be at least 3 km from the airport boundary. Other recreational uses reported as compatible within approximately 5 km of the airport include archery ranges, golf driving ranges, go-cart tracks, dog tracks, skating rinks and bowling alleys.

6.3.12 Commercial activities established in or around the airports can range from shopping centres to cemeteries. The potential risk and effects of an aircraft accident should be considered. The Airport Planning Manual, Part 2, Land Use and Environmental Management, Doc 9184 provides guidance on third party risk due to an aircraft accident around airports. In order to assess such risks, specific methodologies can be developed by States and used to define a dedicated zoning policy, in a similar approach as the zoning policy related to noise exposure.

Although commercial operations can be situated in areas subject to higher noise levels than residential developments, they generally cannot be carried out in the same areas as industrial operations, which are performed primarily indoors and have a higher associated noise level.

6.3.13 The best practice is to remove and prevent from developing residential area in critical noise areas by locating other facilities instead (e.g. industries or road transport system). Residential housing refers to single-family dwellings, multi-family dwellings, and estates. Sound insulation and ventilation should be incorporated in the construction of commercial structures to the extent necessary in order to reduce exterior noise to a level acceptable for conducting business inside the building. Institutional housing refers to community facilities such as schools, hospitals and churches. All these facilities should be planned and situated with thorough consideration of airport noise and the potential risk of aircraft accidents.

CHAPTER 7: DEVELOPMENT AND MANAGEMENT OF INFRASTRUCTURE

7.1 The Airport Business

7.1.1 Over the past 30 years, airports have evolved from being simply municipal or government infrastructure providers into sophisticated and business-oriented service providers. As in every industry, the pressure to operate efficiently is constant and arises from both the customers and stakeholders. Funding of infrastructure is often not addressed in detail within local legislation, and delays in decision making lead to capacity pressure and outdated infrastructure making air travel unpleasant and unsustainable.

7.1.2 Airports are stable providers of infrastructure assets, even in a challenging industry. While airports and airlines are intrinsically linked and rely on one another to operate efficiently, they are based on different business models.

7.1.3 Airlines can move quickly to respond to changes in traffic flows, by leasing or retiring capacity. Airports, on the other hand, must make long-term planning decisions to safeguard capacity sometimes years into the future. In spite of this, through efficiency gains in operations, staff productivity and venturing into new revenue streams, airports have held user charges at a stable 4% of airline operating costs for over two decades.

7.1.4 In the meantime, airports have invested to meet the needs of a burgeoning aviation industry and developed new business models. In recent years airports have played a critical role in keeping air traffic affordable and stabilising operating costs for airlines.

7.1.5 Despite major setbacks such as 11 September 2001, the SARS and EBOLA epidemics, airports have shown high flexibility in dealing with airline customers to relieve some of the financial pressure they endured.

7.1.6 In the early stages of air transport development, the main source of airport revenues was the proceeds from the airport user charges (aeronautical revenues). But revenues from commercial concessions (non-aeronautical revenues) have grown steadily and now represent more than 40 per cent of total revenues.

7.1.7 The growth of a movement of passengers and goods has been demanding to change the structure and business model of airports. In recent years, many airports are adopting the airport city concept and its extension aerotropolis which its planning and activities goes beyond the “fence” of the outer perimeter of the airport.

7.1.8 According to John D Kasarda, “the aerotropolis is a new urban form that relies on an airport and its integrated surface transportation infrastructure to speedily connect high-value, time-sensitive firms to their distant suppliers, customers, and enterprise partners. It consists of a multimodal airport-based commercial core (Airport City) and outlying corridors and clusters of aviation-linked businesses and associated mixed-use commercial/residential developments that complement each other and their accessibility to the airport.”¹⁰

7.1.9 For an aerotropolis, speedy and lower cost access is more important than distance. Firms and business travellers do not have to be located around the airport, but they must be able to access it easily. Connections to the airport through surface corridors such as highways, railways and sometimes waterways become vital to the success of the aerotropolis. Typically, the aerotropolis zone is within 20-30 minutes access time to the airport.

¹⁰Aerotropolis, John D Kasarda, *Entry to the Wiley-Blackwell Encyclopaedias of Urban and Regional Studies* (West Sussex UK: John Wiley & Sons Press, 2016)

7.1.10 Most firms in the high-tech industry depend on suppliers, distributors and customers located thousands of miles away. Access to an aerotropolis allows them to improve their efficiency by reducing cost and delays. The expansion of e-commerce also greatly benefits from the ease of access to all modes of transport offered by an aerotropolis.

7.2 The Airport City (Aerotropolis) Concept

7.2.1 The airport city is comprised of the all buildings, infrastructure, and facilities within the “fence” of an airport. It covers both the air-side (runways, taxiways, aprons, etc.) as well as the land side including terminals and on-airport businesses and facilities.

7.2.2 The new model is almost universally used in the planning for green field airports, with airport cities at Hong Kong, Incheon, Kuala Lumpur and Dubai.

7.3 Study Airport - Aerotropolis Concept of OR Tambo International Airport

7.3.1 ORTIA is the largest airport in Africa and is at the centre of South Africa’s industrial and commercial activities.

7.3.2 The aerotropolis concept at ORTIA sought to build economic strength of the Gauteng Province and South Africa, to be a logistical hub bringing together human capital, jobs and prosperity of the region. The aerotropolis is conceptualized through a 25-year Master Plan that has undergone a:

- Thorough **contextual analysis including environment impact assessment**, both in terms of physical opportunities and constraints as well as community issues and concern;
- Coordinated **project management** to ensure timely input by all consultants, client and community participants involved in the process;
- Full consideration of a broad range of potential **design concepts, policies and programs** that address all opportunities and avoid expedient, preconceived solutions;
- Formulation of appropriate, **site-specific design solutions** with **policies and standards** responsive to physical conditions, client objectives and community concerns;
- Iterative **solutions that are flexible** and able to respond to feedback and new data, enabling cycles of increasingly refined analysis, programming and design; and,
- Careful organization of effective **implementation paths, urban design standards, guidelines and policies**, to help ensure successful implementation once hand-over to the client is complete.

7.3.3 The aerotropolis is proposed as an X-shaped satellite city. This long-term strategy was conceptualized by the “Netherlands Airports Consultants (NACO), where the airport city will be located between the two current runways and a possible addition of two runways as can be seen in Figure 16 below.

Figure 16: Proposed Aerotropolis at OR Tambo International Airport



Source: <http://www.theafricanaviationtribune.com/2013/02/south-africa-pics-johannesburgs-or.html>

The proposed land uses include:

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 center, 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.

The aerotropolis is aimed at;

- Maximization of geographic capabilities through integration of economic & spatial advantages;
- Competitiveness economic through strategic investment;
- Global positioning through branding and enhancement value-proposition;
- Reorganization of industries to optimise efficiencies through clustering to reindustrialize Gauteng; and,
- Improved social and economic infrastructure.

7.4 Study Airport - Sky City Concept of Jomo Kenyatta International Airport

The Sky City is conceptualized in the JKIA Master Plan and aims at fore-casting future aggregate air traffic as well as individual airport traffic forecasts, and to eventually develop a strategy and policy framework to address long-term traffic and to develop master plan for 10 airports, up to year 2030.

Following completion of the NASP study, a master plan was developed for each of the 10 major airports in the country.

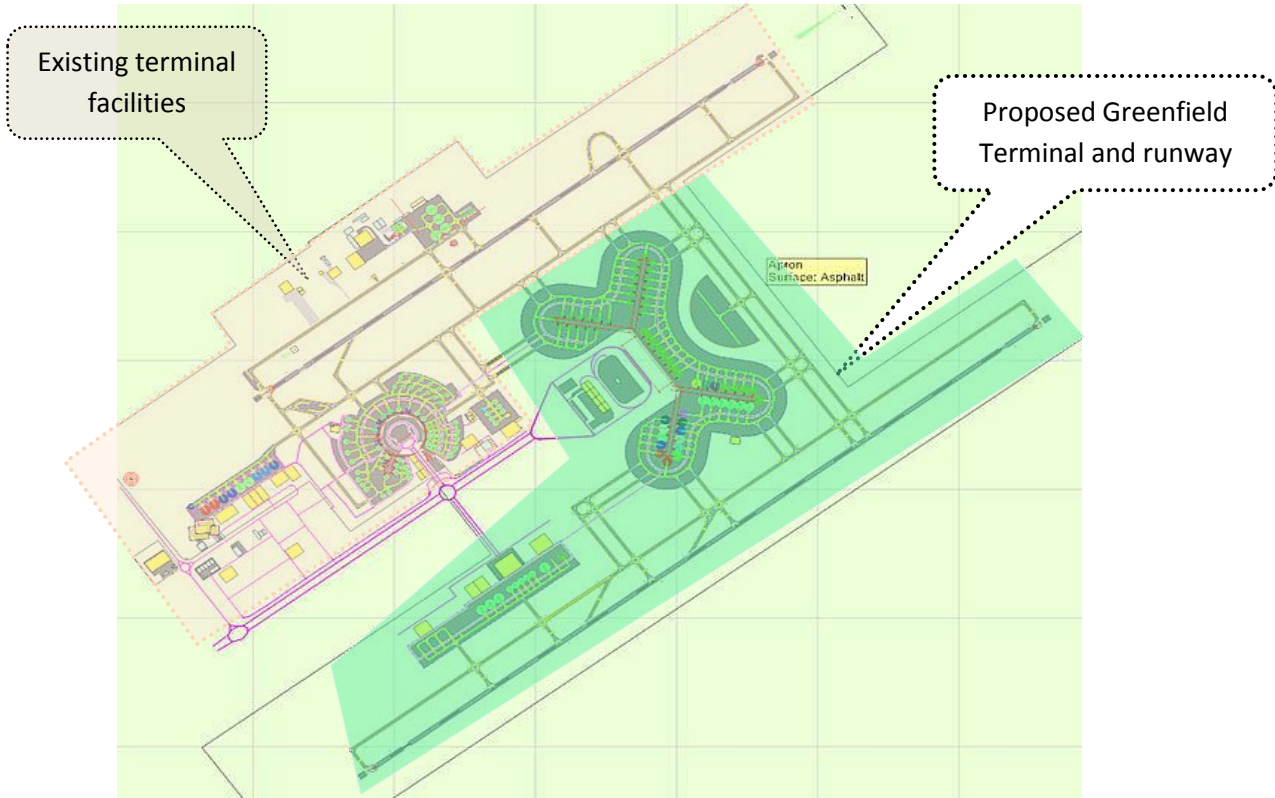
7.4.1 To bridge the gap between demand and supply, the Kenyan government through its Kenya Airports Authority initiated plans to expand the airport by constructing a US\$654 million new terminal dubbed the 'Greenfield Terminal' that is expected to raise passenger handling capacity of the airport to over 25 million. Poised to be the biggest single terminal facility in Africa, the project is projected to be completed in 2016.

7.4.2 There are also plans to build a second run-way that will be a new instrumental landing system-equipped runway, 5,500 meters in length. The US\$146.5 million project will see the airport handle larger aircrafts and enable the airport to operate continuously. Previous accidents and repair works on the current single runway have rendered it unusable, affecting air travel in Kenya.

7.4.3 The expansion and modernization programme for the airport will increase its capacity to handle more and larger aircrafts; optimizing its returns and opening up the airport to more destinations¹¹.

¹¹ Kenya Airports Authority: *Challenges in Handling Demand Growth at JKIA - Nairobi*, November, 2012
<http://www.modernairportsafrica.com/media/7707/7951.pdf>

Map 16: An impression of the proposed Greenfield Terminal at JKIA



Source: Kenya Airports Authority (2016)

7.5 Potential Clientele

7.5.1 An aerotropolis can grow around an existing airport or be planned around a greenfield airport. Potential customers for an aerotropolis in addition to airport operators may include:

- All Passengers
- Accommodation and hotels
- Entertainment
- Convention centres
- Exhibition halls
- Sports complexes and life style centres
- Malls and shopping centres
- Commercial and residential areas
- Parking lots
- Shippers
- Media
- Freight forwarders
- Logistics providers
- Rapid assembly and distribution centres
- Intermodal passenger and freight hubs
- Just-in-time manufacturing firms
- Pharmaceutical firms
- Industrial and high added value products manufacturing firms
- Free Trade Zones
- Advertisement
- ICT service providers
- Scientific Research and Technology Park
- Express couriers
- Business Park
- Mobile services
- Independent companies
- E-commerce

7.5.2 These potential customers may greatly benefit from the increased speed and reduced cost offered by their location within or nearby an aerotropolis.

7.6 Merchandising

7.6.1 Airports have continuously responded to the growth in air traffic by investing in infrastructure, facilities and equipment to ensure the safety and security of operations. At the same time, they continued to develop their commercial activities by offering new products and services to their passengers. From coffee, magazines and duty free in the past, offerings now include also specialty clothing, jewellery, electronics, restaurants, entertainment, accommodation, business centres, parking, etc.

7.6.2 Merchandising is no longer confined to the terminals but have expanded beyond. They are not only designed to passengers alone but increasingly to the public. In some airports, this expansion has occurred in a spontaneous and progressive manner, while in others it was a planned endeavour. The combination gave birth to concept of “airport city”, which recognizes the needs of all airport users and stakeholders and addresses them in a sound and sustainable manner.

7.7 The Airport City Vision

7.7.1 The trend in developing airport cities will assist in minimization of high cost of tax imposed on air transport. High tax lowers competitiveness.

7.7.2 The move is in line with solutions for alternative source for generation of non-aeronautical revenue. This trend should be encouraged in hubs since it will reduce the inconvenience to air transport users and increase the quality of service at specific airport.

7.7.3 Travelling public including business and transit passengers could easily be accommodated at hotels, make shopping whole sales and retails, enjoy recreational activities and entertainment, visit exhibition and museums, fine cuisine degustation, conduct meetings and conferences, consult physicians and undergo medical treatment, participate in auctions, conclude deals in trading, book hotels and tourist packages within and the next destinations, conclude deals in services and for import and export.

7.7.4 In this regard, airports should be provided enough space and avoid compromising expansion. In case of further expansion, a non-adjacent additional space could be allocated to airport for similar development. The non-adjacent space could be connected to the airport by a tunnel, air bridge surface transportation and maritime or in-land water transportation. These connection facilities could be built by public or private corporations. Corporations could generate return on the investment from the tenants of the airport city and provision of advertisement space.

7.7.5 Stakeholders need to develop advocacy message to bring to concerned audience or government to change the mind set on any development with adverse effect on air transport. The travel between city and airport should be made more attractive. The lack of attractiveness could make urban and air transport less competitive from economic perspective. A hubs and spokes network model could be explored to stimulate complementarity of airlines oriented towards improvement of air connectivity and coexistence.

7.8 The Airport of the future

7.8.1 The airport planning process will be linked to each airport’s vision for the future. Some airports may choose to be the centre of an Aerotropolis, while others will choose to become airport cities. In all cases, in order to maximize aviation benefits, reduce costs and improve the efficiency of its users, airports must involve their stakeholders in their planning process.

7.8.2 The airport should review and anticipate changes in the needs of its customers and stakeholders and respond to them in sustainable manner through proper planning. It must respond to

the projected growth in air traffic demand through the timely provision of sufficient capacity and ensure the safety and security of operations while limiting or reducing their environmental impact. It must also ensure that charges paid by aeronautical users are linked to services actually provided and are cost related.

7.8.3 The airport must be well integrated into the environment it serves including the city and the region. Integrated planning covering airport planning, environmental planning, urban and regional planning and business site planning, is essential to have a coordinated master plan to meet the needs of sustainable development. Master planning of the airport must be coordinated with the master plans of the communities. Goals and objectives of each plan need to be defined and respectful of each other. Community engagement ensures that the airport responds to the concerns of the surrounding communities, and effectively communicates the direction of the airport. Thus, future issues such as noise, environmental, or airport development can be effectively managed in the present and in the future. Airport master planning should take into account the requirements stemming from urban and regional planning and vice versa. The master plan should ensure a fast and easy access to the airport for communities and businesses that will be using it. This includes the potential customers for the aerotropolis.

7.8.4 Representatives of the airport users and stakeholders including airlines, general aviation, border security customs, immigration authorities, as well as suppliers and other airport operators, should be consulted in the airport planning process, and to the extent possible, participate in the airport master planning. Infrastructure and surface transportation authorities, such as highway and railway authorities in addition to potential customers cited in 2.8.2.5 should also be consulted. Airport representatives should in turn participate in urban and regional planning activities and ensure that airport planning requirements are taken into consideration. It is essential to engage the community to ensure consistency in the approach to sustainable development.

7.8.5 There may be constraints on airport development depending on whether the airport is an existing or a green field one, and on the availability of space around it. In most case, it is possible to improve airport access thereby reducing time and cost to users. This could be achieved through urban planning and business site planning, as well as the planning and implementation of surface transportation.

7.9 ICAO Policies on Charges for Airports and Air Navigation Services

7.9.1 ICAO's policies on charges for airports and air navigation services have their principal origin in Article 15 — Airport and similar charges, of the Chicago Convention on International Civil Aviation of 1944 stipulating that the application of user charges should not be discriminatory (**foreign aircraft** should be treated in the same manner as **national aircraft** of the same class engaged in **similar operations**).

7.9.2 The policies are contained in ICAO's Document 9082: *ICAO policies on charges for airports and air navigation services*.

7.9.3 The policies, intended for the guidance of Contracting States, are mainly based on the recommendations made in this field by the various conferences on the economics of airports and air navigation services, which are held regularly by ICAO. The last such conference took place in Montréal from 15 to 20 September 2008 (Report of the Conference on the Economics of Airports and Air Navigation Services (CEANS) (Doc 9908) refers). As per a recommendation adopted by CEANS and endorsed by the ICAO Council, States are encouraged to incorporate the **four key charging principles of non-discrimination, cost relatedness, transparency and consultation with users** into their national legislation, regulation or policies, as well as into their future air services agreements, in order to ensure compliance by airport operators and air navigation services providers (ANSPs).

7.9.4 With respect to the scope of charges, it is recommended that States:

- Permit the imposition of charges only for services and functions which are provided for, directly related to, or ultimately beneficial for, civil aviation operations; and
- Refrain from imposing charges which discriminate against international civil aviation in relation to other modes of international transport.

7.9.5 The policies include principles to be applied in determining the cost basis for airport charges, in particular the following:

- The cost to be allocated is the full cost of providing the airport and its essential ancillary services, including appropriate amounts for cost of capital and depreciation of assets, as well as the costs of maintenance, operation, management and administration. Consistent with the form of economic oversight adopted, these costs may be offset by non-aeronautical revenues.
- In general, aircraft operators and other airport users, including end-users, should not be charged for facilities and services they do not use, other than those provided for and implemented under the Regional Air Navigation Plan.
- Airports may produce sufficient revenues to exceed all direct and indirect operating costs (including general administration, etc.) and so provide for a reasonable return on assets at a sufficient level to secure efficient financing in capital markets for investing in new or expanded airport infrastructure and, where relevant, to remunerate adequately holders of airport equity.
- The allocation of costs among aeronautical users should be carried out in an equitable manner.

7.9.6 The principles included in the policies also cover the airport charging systems, landing charges, parking and hangar charges, passenger service charges, security charges; noise related charges, as well as Emissions-related aircraft charges to address LAQ problems at or around airports.

7.9.7 Other principles cover the proliferation of charges, organizational and managerial issues, economic oversight, economic performance and minimum reporting requirements, consultation with users, pre-funding of projects and currency issues.

7.9.8 The policies recognize that in some cases revenues from user charges may not be sufficient to cover the high fixed costs of airports. Therefore, an airport may expand their activities to include concessions and other commercial initiatives to cover their costs and expand their business while maintaining the highest degree of safety and security for passengers and cargo.

7.9.9 Similar principles related to charges for the provision of air navigation services are also included in the policies referenced in Document 9082.

7.10 ICAO Policies on Taxations in the Field of International Air Transport

7.10.1 In recognition of the role that international air transport plays in creating and preserving friendship among peoples of the world, and in supporting the economic and social development of nations, ICAO has developed long standing policies on taxation in the field of international air transport designed to promote its development.

7.10.2 The need for these policies is justified by the unique nature of international air transport whereby major expenses are incurred outside the borders of the States of Origin and Destination of passengers and cargo transported. Taxation in the field of international air transport covers many aspects, considering the variety of items which may be subject to taxes and the types of taxes that may be levied. Amongst the items which are usually taxable and have been considered in the past in connection with avoidance of multiple taxation are those pertaining to fuels, lubricants and other consumable technical supplies used by aircraft during flight, the income derived from operating

aircraft, the aircraft itself and its components, spare parts and ground equipment necessary for its operation. The taxes levied may include income taxes, import, export, excise, sales, consumption or internal duties or taxes. Unlike other types of enterprises of one State doing business in another State, the earnings of international air transport are based upon the use of aircraft requiring large amounts of fuel in operations between various tax jurisdictions, and a considerable percentage of these operations are conducted outside any tax jurisdiction; i.e., over the high seas.

7.10.3 Article 24 (a) of the Chicago Convention on International Civil Aviation of 1944 states that fuel and lubricating oils on board an aircraft of a Contracting State on arrival in the territory of another Contracting State and retained on board on leaving the territory of that State shall be exempt from customs duty, inspection fees or similar national or local duties and charges. The same Article of the Chicago Convention also refers to the temporary admittance, free of duty, of aircraft on a flight to, from or across the territory of another Contracting State and to the exemption from customs duty, etc., of spare parts, regular equipment and aircraft stores.

7.10.4 Subsequently and in view of the significant changes which international civil aviation had undergone, the ICAO Council has developed policies with respect to:

- Taxes on fuel, lubricants or other consumable technical supplies (whether on-board on arrival or taken on-board before departure; exemption from customs and other duties on a reciprocal basis);
- Taxation of income of international air transport enterprises (exemption from taxation on the income of air transport enterprises of other Contracting States) and taxation of aircraft and other moveable property (exemption from property taxes, and capital levies or other similar taxes, on aircraft and other moveable property of air transport enterprises of other Contracting States);
- Taxes on the sale and use of international air transport (reduction and to the extent possible elimination of all forms of taxation on the sale or use of international transport by air, including taxes on gross receipts of operators and taxes levied directly on passengers or shippers).

7.10.5 These policies are outlined in ICAO's Document 8632: *ICAO's Policies on Taxation in the Field of International Air Transport*.

7.10.6 At each regular session of the Assembly, every State is requested to implement these policies.

Extract from Assembly Resolution A38-14

The Assembly:

1. *Urges Member States to follow the resolution of the Council as contained in Doc 8632, ICAO's Policies on Taxation in the Field of International Air Transport so as to avoid imposing discriminatory taxes on international aviation;*
2. *Urges Member States to avoid double taxation in the field of air transport; and*
3. *Requests the Council to ensure that the guidance and advice contained in Doc 8632*

7.11 Aviation Security

7.11.1 Implementation of effective security and facilitation measures at the airports is necessary for economic development of airports and related synergies with urban and national development. Disruption of operations at airports due to security threats/attacks directly affects the connectivity with the urban centres and affects the movement of people and goods both locally and internationally.

7.11.2 The various challenges faced in aviation security today as a result of terrorist activities include suicide bombers, cybercrime, insider threats and attacks targeted at the airports from outside the perimeter fence. The airports and surroundings areas should be perceived to be safe enough to encourage and attract development around the airports.

7.11.3 Aviation security requires proper planning and supervision as well as coordination with various concerned agencies such as Police, Immigration, the customs industry, whereby some unlawful acts can hinder economic developments in and around airports and cities.

CHAPTER 8: IMPACTS OF AVIATION ON URBANISATION AND SOCIOECONOMIC ACTIVITIES

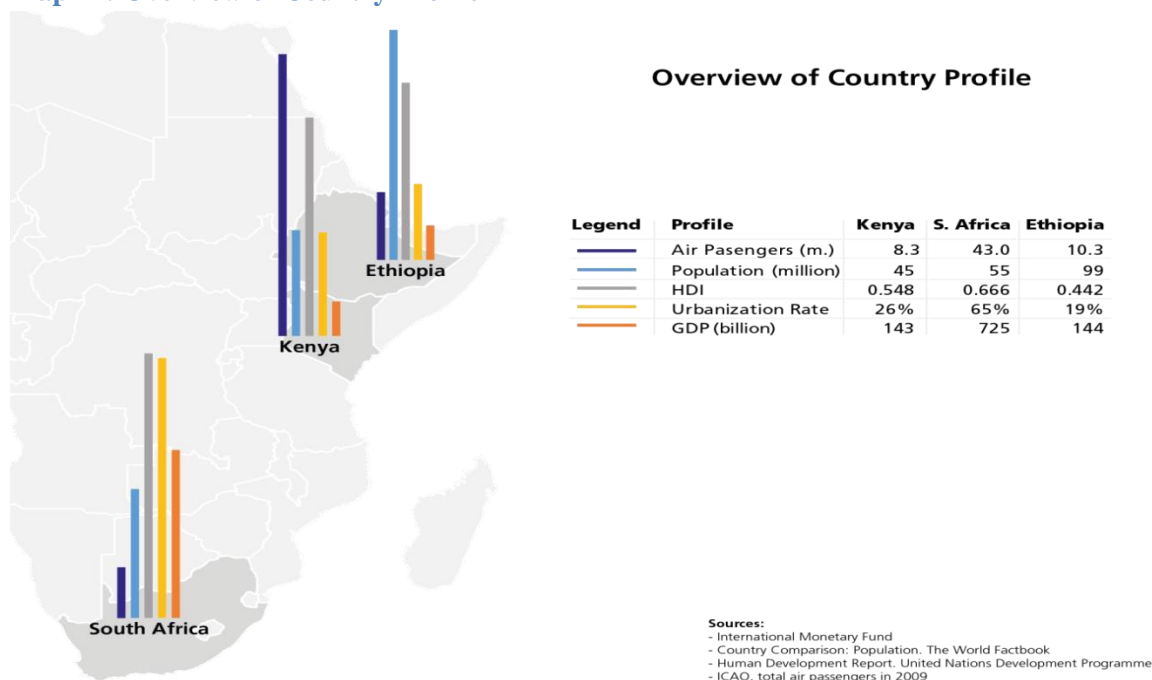
8.1 Urbanization in Africa has been a crucial tool that has brought opportunities to provide basic needs and services to urban dwellers in Africa at affordable costs and has been a major driver of development. Majority of most countries' GDPs were generated in urban areas. In Kenya for instance, Nairobi has been contributing more than 50% to the country's GDP. Forces that come to interplay in the urban areas create conducive growth synergies that can be harnessed to promote sustainable urban growth.

8.2 Reform in urban and territorial planning and development needs to be bolstered using evidences, adequate legal and policy documents, promotion of implementable institutional reform, responsible decentralization of urban services, promotion of co-operation with and among urban development partners, tailored made capacity building at the urban management level, closing of the inequality gap and urban governance. These will ultimately lead to more sustainable urban settlements, which are compact, less impactful on the environment, resilient to climate change, responsive to human rights and more connected. Airports can also be advocates for environmentally sustainable initiatives triggering local projects (e.g. charging points for electric vehicles, best practices in terms of waste and water management etc).

8.3 Integration of airport infrastructure development and aviation development are an entry point in promoting sustainable growth of the urban and aviation sectors. A collaborative effort towards harmonizing top-down regulatory frameworks and bottom-up national and city level urban growth regulations, policies and programmes must be well articulated and enhanced by all stakeholders in the urban and aviation sectors to ensure sustainable urbanization to realize synergies and meet the targets set out in the Sustainable Development Goals.

8.4 In 2014, the global total economic impact of aviation reached 3.5 per cent of the world's GDP or 2.4 trillion US dollars. The sector supported the global employment of 58.1 million people, given its cross-cutting nature and multiple links to other economic sectors. Aviation supported 8.5 million jobs in 2014 and its direct economic impact reached approximately USD 700 billion. Over 1.1 billion tourists crossed international borders, over half of who travelled by air to their destinations and up to 80 per cent of visitors to certain small island states. Air freight constitutes 34.6 per cent of world trade by value despite this being only 0.5 per cent by volume.

Map 17: Overview of Country Profile



©Runze, 2016, Source: *Africa Infrastructure Country Diagnostic: Air Transport Challenges to Growth, June (2009)*¹²

8.5 Air transport has proven to be a catalyst for sustainable development. It impacts tourism and trade. It serves as the main mode of transportation to deliver humanitarian relief and response to crises and public health emergencies. It generates socio-economic benefits which help eradicate poverty by creating jobs and by enhancing air connectivity. Furthermore, this sector is forecast to grow from 33 million departures today to 60 million by 2030. Its global economic impact (direct and indirect) is estimated at \$1.3 trillion, equivalent to 1.9% of world GDP. Apart from being a major global source of employment generating 18.6 million jobs globally, the air transport industry invests substantially in vital infrastructure with \$19.3 billion allocated to airports in construction projects in 2012.

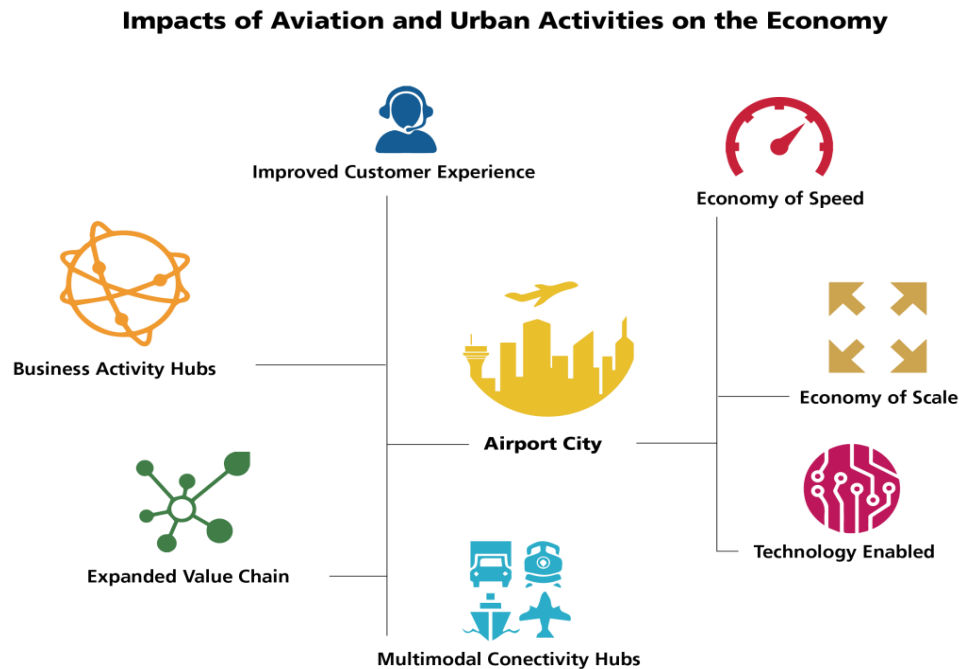
8.6 Aviation currently moves over half of the 1.1 billion tourists who travel across international borders each year – a figure which rises to over 80 per cent in various island states. In 2013, 49.2 million tonnes of cargo worth USD 6.4 trillion were handled by air. By the year 2030, air cargo traffic is expected to have tripled to an estimated 150 million tonnes. Although only an estimated 0.5% of the volume of global trade is carried by aircraft, it accounts for 35% of the total value of global trade. For LDCs, and especially for LLDCs and SIDS, aviation represents an essential lifeline to facilitate trade. In fact, the Programmes of Action agreed for these groupings of States in special situations, namely: the IPoA, the VPoA and Small Island Developing States Accelerated Modalities of Action (Samoa Pathway) recognize that the development and maintenance of aviation infrastructure services are essential to achieving sustainable development in LDCs, LLDCs and SIDS, and call for specific actions to attain their objectives.

8.7 In order to accommodate this traffic, it is of significant importance that all States develop quality and resilient aviation infrastructure compliant with the international requirements adopted by ICAO, including on environmental protection. Aerodromes are considered an integral and essential component of the aviation infrastructure in a State. They are drivers for economic development and trade. A poorly designed and overseen aerodrome or an aerodrome which does not meet international requirements adopted by ICAO has been proven to be a safety risk, as well as a barrier for the

¹² World Bank: <http://siteresources.worldbank.org/EXTAIRTRANSPORT/Resources/515180-1262792532589/challenges.pdf>

economic development of a State. Given the dependence by LDCs, LLDCs and SIDS on aviation, a single aviation accident can have a substantial effect on their economies. Thus, it requires international support and partnerships to ensure that essential aviation infrastructure including aerodromes, navigation aids and fire safety equipment are upgraded to modern international standards and operated effectively to guarantee safety and economic stability.

Figure 17: Impact of Aviation on the economy



©Runze, 2016, Source: ACSA

8.8 Despite its socio-economic significance and before the adoption of the 2030 Agenda for Sustainable Development, no consideration was given to the fact that air transport is an enabler of sustainable development and that improvements in this sector are intrinsically related and should be embedded within global, regional and national development frameworks. This situation has posed challenges for States, especially LDCs, LLDCs and SIDS, in securing resources required for the development and improvement of their air transport systems. It also hampered the establishment of partnerships among members of the UN system and other stakeholders to support air transport development.

8.9 The relatively low share of air transport for LDCs, LLDCs and SIDS monitored through the SDG indicator 9.1.2 (Goal 9, Target 9.1) (see Table 3), can be attributed to restrictions or barriers posed on air services among States along with the lack of quality, reliable, sustainable and resilient air transport infrastructure, which is also monitored by ICAO USOAP through the indicator “Percentage of effective implementation in the infrastructure development of AGA EI” (see Table 3). These impediments may be caused by ineffective policies that constrain connectivity, the lack of investments needed to improve or develop the aerodrome infrastructure needed to face the projected increase of air traffic, the lack or poor planning need to enhance this type of infrastructure or the absence of coordination among Stakeholders.

8.10 Assisting States to liberalize air transport, to close the infrastructure gap that exist among States, in particular in LDCs, LLDCs and SIDS, and to coordinate the effective planning to enhance air transport systems is paramount to ICAO so that No Country is Left Behind in achieving their optimal air transport potential that will ultimately contribute towards the realization of the 2030 Agenda for Sustainable Development.

Table 3: Passenger and Freight Volumes of Air Transport

	Total passengers	Share of passenger	Total freight tonnes carried	Share of freight tonnes carried
World	3,303,349,219		50,351,508	
Developing Regions	1,488,317,905	45.05%	26,087,125	51.81%
<i>Northern Africa</i>	27,465,990	0.83%	167,082	0.33%
<i>Sub-Saharan Africa</i>	44,853,931	1.36%	612,980	1.22%
<i>Latin America and the Caribbean</i>	240,229,220	7.27%	1,922,358	3.82%
<i>Eastern Asia</i>	522,639,082	15.82%	12,444,007	24.71%
<i>Southern Asia</i>	114,948,811	3.48%	1,247,289	2.48%
<i>South-Eastern Asia</i>	279,378,708	8.46%	3,584,099	7.12%
<i>Western Asia</i>	244,116,326	7.39%	5,984,751	11.89%
<i>Oceania</i>	4,172,294	0.13%	56,351	0.11%
<i>Caucasus and Central Asia</i>	10,513,543	0.32%	68,208	0.14%
Developed regions	1,815,031,314	54.95%	24,264,383	48.19%
Least Developed countries	26,381,089	0.80%	514,474	1.02%
Landlocked developing countries	97,713,083	2.96%	667,942	1.33%
Small island developing States	54,464,259	1.65%	1,276,418	2.54%

Source: ICAO, 2014

It is well understood by the international aviation community that the benefits enabled by air transport can only be materialized if States have a safe, efficient, secure, economically viable, and environmentally sound air transport system. The sustainable development of the air transport is dependent on airport development and infrastructure financing supported by thorough and effective coordination among relevant stakeholders.

8.11 Apart from financing and infrastructure development, there is a need to improve the regulatory and operational environment of airports as per the international Standards and Recommended Practices of ICAO. Some of the major reasons for airports to operate below the standards are:

- State's poor aerodrome regulatory framework;
- Lack of a robust aerodrome certification process, including a safety assessment mechanism;
- Lack of robust environmental management systems;
- Inadequate staffing of the aerodrome regulatory authority by qualified and experienced staff from relevant educational backgrounds to ensure an appropriate mix of technical disciplines needed for aerodrome certification activities; and

- Non-adherence of the Aerodrome Operator to the certification process (ex: no comprehensive aerodrome manual developed, compliance checklist not completed, etc.).

8.12 All these reasons for poor implementation of the aerodrome certification requirements fall in the range of activities that can be prioritized for applicable financing mechanisms. The financing of airport infrastructure and building the capacity in States to ensure that such infrastructure meets minimal international standards initiatives and improve navigational efficiencies (with resultant economic and environmental benefits) merit significant support from public and private sources. Usually, the sources of financing aviation infrastructure are public financing, public and private partnerships and its variant models, development banks and ODA. Financing is sometimes made available at rates lower than the market rates and or for durations longer than the norm, with an element of grant embedded in the financing and/or with an equity element embedded in the financing.

8.13 It is also important that improvements to aviation infrastructure needed in a State to enhance its connectivity are effectively coordinated amongst relevant authorities, including those with responsibilities for air transportation and urban and territorial planning, in mutual understanding of planning and policy frameworks at the national, sub-national, and local levels. This coordination is normally reflected in sustainable urban and metropolitan transport and mobility plans as well as transport sector strategic plans, civil aviation and airport master plans, hence the combination of effort converge to the implementation of the Sustainable Development Goal 11. Relevant authorities are called to support sub-national and local governments to develop the necessary knowledge and capacity to implement and enforce such plans.

8.14 Study Airports

8.14.1 The vast majority of Ethiopia's air passenger traffic flows through **Addis Ababa Bole International Airport**. In 2011, nearly 5.2 million total passengers passed through the airport – 4.6 million international passengers and 0.5 million domestic passengers. Approximately three quarters of international traffic at the airport is intra-African. It is the main hub of Ethiopian Airlines, the flag carrier that serves destinations in Ethiopia and throughout the African continent, as well as non-stop service to Asia, Europe and North America.

8.14.2 **Jomo Kenyatta International** in **Nairobi** is Kenya's foremost international airport, serving nearly 80% of the country's air passenger traffic. In 2011, the airport served a total of 5.0 million passengers – 3.8 million international passengers and 1.2 million domestic passengers. It has scheduled flights to destinations in over 50 countries and is the main hub for Kenya Airways and Fly540. Kenya Airways is the country's largest domestic airline and was the first African flag carrier to successfully privatize its operations. Launched in 2006, Fly540 is a low-cost carrier that operates domestic and international passenger and freight services. Moi International Airport in Mombassa is Kenya's second largest airport, serving over 1.3 million passengers in 2011 – 0.5 million international passengers and 0.8 million domestic passengers. In addition to handling direct flights to Europe, the airports offer connections to several regional destinations. Both Jomo Kenyatta International and Moi International are operated by the Kenya Airports Authority.

8.14.3 **Wilson Airport** in **Nairobi** is Kenya's second busiest airport handling general aviation, domestic and regional traffic in Kenya and Eastern Africa respectively.

8.14.4 South Africa is host to several of the busiest airports on the continent. Around 90% of the 35.9 million passengers – 10.5 million international passengers and 20.4 million domestic passengers - that transited through airports in South Africa in 2011 went through the Johannesburg (18.9 million), Cape Town (8.4 million), or Durban (5.0 million) airports. **OR Tambo International Airport, in Ekurhuleni Metropolitan Municipality**, serves as the primary airport for domestic and international travel to/from Africa and is Africa's busiest airport with a capacity to handle up to 28 million passengers annually. The airport is the hub of South Africa's largest international and domestic carrier, South Africa Airways, as well as a number of local airlines, including Airlink, South African Express, and Kulula.

8.15 Due to the rising global population, urbanization is one of the 21st century's most transformative trends. Even though the concentration of population, economic activities, social and cultural interactions in the cities has most likely a potential positive implication on the growth and development of air transport, it might also equally cause major sustainability challenges unless they are appropriately addressed in a coordinated and effective management system.

CHAPTER 9: PROVISION OF PUBLIC AMENITIES AND BASIC SERVICES IN AIRPORTS

9.1 Energy

9.1.1 The majority of energy used at an airport is associated with the provision of heating, ventilation, air conditioning and lighting. The essential services such as airfield lighting and instrumentation actually use a relatively small amount of energy. It is estimated that energy costs account for about five per cent of the operating costs of a modern airport. To access energy and environmental performance, suitable indicators are required. The actual choice of indicators will depend on the size of the airport, however, suitable indicators may include:

- a) Energy consumption; and
- b) Local air quality and greenhouse gases levels.

9.1.2 Energy consumption and reduction strategies should be monitored and reported on annually in order that performance improvements can be demonstrated and compared to other indicators, such as traffic, finance and employment. Goals and objectives should form any energy strategy or plan, which should meet those set forth by the State and local community and integrated into airport operations. It is necessary to record annual energy consumption and to have information on the effects produced by using various energy sources. Measured of consumption are essential for reports on environmental effects, indicators based on cost are essential from a management viewpoint. Some airports adopt an energy policy guidance statement turning them into effective action requiring a clear definition of responsibility for energy efficiency. Ideally, each operational manager will have energy responsibility, with expert knowledge being provided by engineering and energy specialists. An effective energy strategy will include a statement of objectives to make all personnel aware of what the organization is committed to achieve, but the pursuit of environmental performance without regard for cost is not a plan for success. Main elements of energy strategy:

- Choice of energy source including renewable energy; and
- Effective utilization and management of energy.

9.1.3 To be effective, energy audits should be carried out at regular intervals. All control points related to heating and air conditioning systems should be checked. All measures can optimize the performance of the system. Where a comprehensive building management system is installed, many checks and adjustments can be carried out from a central control room. Sometimes it is possible to reduce the requirement for artificial lighting by the introduction of more natural lighting — providing this does not add significantly to heat or cooling loads. The Environmental Management System should be the overall framework for the energy management plan and strategy.

9.1.4 Study Airports – Energy

9.1.4.1 Addis Ababa Bole International Airport is very well served with one dedicated transmission line and one metropolitan transmission line. No blackouts have been experienced at the airport. Technical assistance is provided promptly by the supplier whenever need arise. The current capacity is adequate for future development. EAE back-up capacity is extended to terminals and parking as well as to all service providers at the airport. The perimeter is illuminated through solar power.

9.1.4.2 Jomo Kenyatta International Airport and Wilson Airport are privileged customers of public and private services providers and the formalities for delivery of services such as energy, telecommunication, sewage and water at the airport are fast tacked.

9.1.4.3 The energy service at **OR Tambo and Lanseria Airports** is sustainable with no shortage or blackout reported, and the capacity will be increased in the near future. ACSA and Lanseria International Airport comply with ICAO requirement in such a way there are backup generators which are maintained regularly. ATNS also has back- up power supplies made up of batteries and

generators to guarantee continuous operations of VHF and Control Towers in case of outage from the public power network.

9.4.4 Ekurhuleni Metro and the Provincial Government are planning to introduce solar plans for renewable energy. It is still exploring the availability of suitable storage technology in the local market.

9.2 Water, Sewer, And Drainage

9.2.1 Surface water is most often affected, as pollutants run off the airport pavements and enter into the streams, rivers, lakes, etc. However, sub-surface water may also become contaminated when leaks or spills of fluids seep through the soil into the ground water.

9.2.2 Airports use a variety of chemicals in their day to-day operations. If not properly controlled, these contaminants may have harmful effects on nearby surface and/or subsurface (ground) water. The servicing of aircraft and ground vehicles can result in the discharge of industrial effluents, e.g. paint stripping, metal coating, detergents from aircraft, and vehicle and pavement washing.

9.2.3 The discharge of chemical pollutants can disturb aquatic life and diminish water quality in three primary ways:

- Toxic effect;
- Eutrophication;
- Oxygen depletion.

9.2.4 Attention should also be given to any change in the ecosystem of desert areas. Specific attention should be directed to the loss of natural plants upon which animals feed. If the airport has a water desalination plant, the concentrated saline solution generated should be treated as waste matter. The treatment and disposal of this waste should be considered during the planning phase of the airport facilities.

9.2.5 Airport Water Quality Management Plans should be designed to take into consideration all activities at the airport, for the protection of surface and sub surface water. Airports are subject to both State and local environmental regulations which may include both quantity and quality discharge limits. Airport waste water must be treated before being discharged so as not to pollute ground water or nearby streams. Waste water may be treated on site or at a nearby municipal treatment system. It should be noted that local water quality regulations may require pre-treatment before discharge to a municipal system. In order for airport operators to control waste water at their facilities, pollution prevention planning can identify areas and activities to be managed. The type and nature of airport operations will influence the type and extent of waste water treatment. The primary products which can be found in untreated waste water discharges include fuel, oil and greases, and heavy metals. With respect to water pollution management the following applies:

- Water quality monitoring should be emphasized as water could be stored for long periods of time in underground or elevated reservoirs not frequently cleaned and/or liable to contamination;
- Water conservation practices should be adopted when planning the airport facilities;
- Oils and fuel should be contained and segregated at their source;
- The use of desalinated water can cause piping system corrosion so the aggression index for the water should be monitored.

9.2.6 In order to determine the type of practices to be incorporated in a water pollution control programme, airport operators should conduct a review of the site conditions. This review should include the following:

- Topography;

- Presence of bodies of water;
- Storm water discharge points, including infrastructure and natural bodies of water;
- 100-year flood levels and impact on drains, culverts and catch basins;
- Paved areas and buildings;
- Aircraft and vehicle service areas; and
- Operational areas and activities, i.e. fuelling, de-icing.

9.2.7 The amount of water for foam production, and the complementary agents to be provided on the Rescue Firefighting (RFF) vehicles should be determined in accordance with the airport category. Airports have developed centralized firefighting training areas to contain the effluent from the foams. Specialized training procedures and alternative fuel sources such as propane and natural gas reduce the use of liquid fuels which can be harmful to the environment. Control measures at the training sites provide real time simulations of aircraft fires. The main environmental considerations for airport fire and rescue activities are the training areas for simulated fire training and the recovery of related storm water run-off. The infrastructure for these activities should include a fire training area with road access as well as facilities for handling the fuels used, and for the collection and containment of run-off water. For more information please see ICAO Doc 9137 Airport Services Manual Part 1 Rescue and fire Fighting

9.2.8 The WHO provides comprehensive guidance to ensure quality and safety of drinking-water. Most of the concerns focus on acute risk because of short-term and limited exposure conditions. Thus, microbial risk is the principal concern, although a few risks associated with the acutely toxic chemicals also exist. It is required to every airport specifically designated by a State to have or develop within a limited period the capacity to provide safe potable water supplies or travellers using airport facilities. It is necessary to take all practicable measures to ensure that international conveyance operators keep their conveyances free of sources of contaminations and infection (including drinking water). WSPs are the most effective management approach for consistently ensuring the safety of a drinking water supply. A WSP has three key components, which are guided by health-based targets and overseen through drinking water supply chain surveillance. They are:

- System assessment (description of source, identification of hazard, control measures, maintenance etc.);
- Operational monitoring; and
- Management and communication.

9.2.9 The airport operator is responsible for the safety of the potable water supply at the airport. The airport operator is generally subject to surveillance by the governmental authority responsible for regulating or licensing environmental health standards for facilities open for public space. The airport operator is in charge of all sanitation facilities at airport area as they have to provide access to safe, convenient sanitation facilities. It is recommended to establish an environmental emergency plan, to respond to potential hazards.

9.2.10 Study Airports - Water

9.2.9.1 Addis Ababa Bole International Airport has enough potable water capacity and a backup capacity which can be available up to 15 days. It is supplied through a dedicated line and the water is paid on a residential rate. The cooperation between the supplies and airport is good. There is an integrated automated system for distribution in the airport including fire service. Water is supplied to all service providers at the airport. Supply from ground water supply within the vicinity of the airport may be explored in the future. The maintenance of the reservoir is periodic. It should be noted that the quality of water meets international standard.

9.2.9.2 Water in all aviation facilities of the **OR Tambo and Lanseria International Airports**

including the Aerotropolis, is safe to drink. The control is made through the National Blue Drop Certification System. Both OR Tambo and Lanseria International Airports have water reservoirs on 24 hours standby for fire and rescue service.

9.3 Solid Waste

9.3.1 Movement of aircraft and ground vehicles, fuelling operations, aircraft maintenance and repair work (including painting and metalwork), engine test cell operations, and ground vehicle maintenance, are all sources of airport industrial waste. Waste management at an airport may require permits and registration due to State and local requirements waste management is concerned with the reduction of both hazardous and non-hazardous wastes.

9.3.2 The disposal of environmentally harmful materials used in aircraft servicing and maintenance (e.g., oils, cleaning fluids and paints) and of waste from the airport and incoming aircraft should be managed effectively. Guidance in this matter can be found in ICAO Doc. 9184 part 2.

9.3.3 Study Airports – Waste Disposal

9.3.3.1 Waste disposal has a shared responsibility of the airlines, the airport operators and the ground service providers. They must use an effective system for the removal, transport and disposal of solid and liquid waste. The Airport Planning Manual – Part 2, Land Use and Environmental Management mentions the requirement for an effective 4R program: reduce, reuse, recycle and recover, as well as guidance on effective waste management program which can be enhanced by employee awareness of waste management practices. In some jurisdictions, agricultural security concerns can mean that local regulations require that waste from international flights be subject to special segregation and handling rules and may not be allowed to be recycled. The disposal of animal by-products may require the construction of incineration facilities.

9.3.3.2 Addis Ababa Bole International Airport has installed a collection location of packaged waste on the land side for removal by the municipality twice a day to avoid the frequent presence of birds and animals which may become hazard. The ecological study has covered the aspect related to attraction of animals to such site. Airport Wildlife Group undertakes awareness activities with the communities at the vicinity of the airport. A Memorandum of Understanding has been signed with the community for activities within the vicinity of the airport.

9.3.3.3 Dumping sites have been relocated to a distance of 13 km from the airport, and clear of the airport approach, and take-off path. There is an abattoir which will be relocated.

9.3.3.4 A sewage lifting system is connected to the municipality network. The collaboration with the service provider is good, and the cost applied is residential. However, the capacity needs to be improved due to the expansion.

9.3.3.5 There is no challenge originated by the drainage at the landside of the Addis Ababa Bole International Airport. However, there are challenges on the metropolitan side for rain storm water affecting traffic on the access road to the airport. It should be noted that the airport has never reported this situation to the metropolitan authority.

9.3.3.6 More efforts on sanitation, waste management, and storm water drainage are needed at **Jomo Kenyatta International and Wilson Airport**. It is foreseen that Nairobi City County government may be allocated an office at the planned airport city for close follow up on the delivery and functionality of public services.

9.3.3.7 To avoid concentration of birds within the vicinity of the airports appropriate measure have been undertaken to ensure good solid waste disposals methods are deployed. KAA has wildlife

hazard management plans for each airport. The plans are reviewed from time to time in order to ensure wildlife hazards are reduced or eliminated in line with the aerodrome certification requirements as spelt out by the regulator, KCAA

9.3.3.8 Ekurhuleni and Johannesburg Metros Provide Adequate Services to OR Tambo and Lanseria International Airports for Waste Management

Municipal sewage system at OR Tambo International Airport is reaching its maximum capacity. However, no shortcomings may occur in both landside and airside of the airports. Metropolitan Authority is migrating to integration of the public system while expanding the system to provide more capacity.

9.3.3.9 The underground system at OR Tambo International Airport is being completed by surface extension for drainage of storm water to enable containment in dams in order to regulate the flow. There is separation of chemical fluid such as fuel. The airport zone and the municipality have to date not experienced intense flooding which may cause major disturbance to daily economic activities.

9.4 Information and Communication Technology (ICT)

Information and communication technology (ICT) provides the technological backbone for air transport. All logistics for the processing and movement of aircraft, passengers and cargo are impossible without efficient and effective ICT architecture and operation. A disruption to ICT infrastructure in a State has adverse impact on the safety and efficiency of air transport operations.

9.4.1 Metropolitan authorities are required to assist in speeding up the penetration at the pace of adoption of ICT in the airports. Metropolitan authorities need to create for the cities and airports suitable conditions allowing use of technology by the population through suitable electronic device for the purpose of, among others, flight booking, airport timetables consultations, home printed boarding card and baggage tag, e-ticket purchasing, e-visa application and e-cargo processing in order to catch with the pace of development. Suppliers of the technology are sited in the city. While catching with the pace of development, necessary action for cyber-security should be taken to ensure measures for security are in place.

9.4.2 Study Airports - ICT

9.4.2.1 The capacity of the ICT will be increased to meet the demand with the expansion of the terminal of the **Addis Ababa Bole International Airport**. Ethio telecom has dedicated communication service for ECAA and Ethiopian Airport Enterprise was approved and is operational.

9.4.2.2 Nairobi County assists in speeding up the penetration at the pace of adoption of ICT in the **Jomo Kenyatta International and Wilson Airports**. The County creates the city suitable conditions allowing use of technology by the population through suitable electronic device for the purpose of, among others, flight booking, airport timetables consultations, home printed boarding card and baggage tag, e-ticket purchasing, e-visa application and e-cargo processing in order to catch with the pace of development. Suppliers of the technology are sited in the city. While catching with the pace of development, necessary action for cyber-security is taken to ensure measures for security are in place.

9.4.3.3 Four major cellular network providers with major fixed line operators are providing service to **OR Tambo and Lanseria International Airports**. The service is considered of high capacity in both metros. The new programme on fibre optic is ongoing at O.R. Tambo International Airport. All centres will be covered by Wi-Fi within three years. The Aerotropolis will be provided with a data management connection by a specific company which also controls the usage of power by major consumers. Provision of Wi-Fi at airport terminals is independent. ATNS has its internal virtual private telecommunication system for operational use which includes both leased- and owned network services.

9.5 Fire and Rescue Service

9.5.1 The principal objective of an RFF service is to save lives in the event of an aircraft accident or incident occurring at, or in the immediate vicinity of, an airport. The RFF service is provided to create and maintain survivable conditions, to provide egress routes for occupants and to initiate the rescue of those occupants unable to make their escape without direct aid. This service must assume at all times the possibility of and need for extinguishing a fire or response to an environmental emergency such as spill, release of hazardous products, or other aircraft and airport incidents. The RFF service at an airport should normally be under the administrative control of the airport management, which should also be responsible for ensuring that the service provided is organized, equipped, staffed, trained and operated. Supporting plans and procedures such as the airport environmental emergency plan and airport security plans should complement the overall disaster / emergency plan to ensure consistency in response procedures.

9.5.2 The airport management may designate public or private organizations suitably located and equipped to provide/support the RFF service. It is intended that the fire station housing the RFF service be located on the airport premises and suitably located so that responses will not be delayed and will ensure response (2 minutes) times can be met. It is intended that the above include the availability of suitable specialist vehicles, rescue equipment and services for an airport located close to water, swamp, desert or other difficult environments, where a significant portion of aircraft approach or departure operations takes place over these areas.

9.5.3 Coordination between the RFF service at an airport and public protective agencies that may be called upon as supporting agencies should be established by prior agreement for assistance in dealing with an aircraft accident or incident. The level of protection to be provided at an airport should be based on the dimensions of the aeroplanes normally using the airport as adjusted for their frequency of operations. Airports should be categorized for RFF purposes by counting the aeroplane movements in the busiest consecutive three months of the year.

9.5.4 The efficiency of an RFF service is significantly dependent on the reliability and effectiveness of its communication and alarm system. In addition, the successful conduct of the total fire-fighting and related rescue operation will be facilitated by the system for alerting and mobilizing other participating emergency support personnel. The importance of prompt and clear communications cannot be over-emphasized.

9.5.5 Any decision regarding the provision of ambulances should take into consideration the ambulance facilities available in the area of the airport and their ability to meet within a reasonable period of time a sudden demand for assistance on the scale envisaged. Regard should also be made to the suitability of such ambulances for movement on the terrain in the vicinity of the airport. The ambulance service may be part of the airport RFF service.

9.5.6 Where it is deemed that the ambulance service provider(s) is located off the aerodrome, the aerodrome operator should coordinate within their airport emergency plan and procedures, the necessary commitment from such medical facilities in the event of an aircraft emergency. These procedures should take into account, factors such as proximity to the aerodrome; operating hours and capacity of the medical facilities; expected traffic situations; local terrain; and weather conditions that will affect the expeditious response and the subsequent effective delivery of medical aid. This commitment should be formalized through mutual aid emergency agreements between the aerodrome operator and the ambulance service provider(s).

9.5.7 In the absence of such mutual aid emergency agreements, commitment by the ambulance service provider(s) can also be demonstrated by the activation, deployment and response of resources during full-scale aircraft crash exercises. On the other hand, where it is decided that the provision of an ambulance or ambulances by the appropriate authority is necessary, every airport should establish an emergency plan to deal with aircraft emergency situations. The plan should include a set of

instructions dealing with the arrangements designed to meet emergency conditions and steps that should be taken to see that the provisions of the instructions are periodically tested.

9.5.8 Only in this way can it be established whether the organization is capable of coping with every possible contingency and that the authorities, as well as each individual, services and agencies concerned, will be acquainted and familiar with the action to be taken. These instructions should set out in sequence the specific duties of each section concerned (e.g. air traffic control, RFF service, security managers, aerodrome operations managers). They should cover the arrangements for calling the rescue and fire-fighting service to aircraft accidents, both on and off the airport and for the summoning of assisting municipal services, rescue and medical, where available.

9.5.9 The chief link in the organization is that between RFF service and air traffic control, and it is essential that the closest possible liaison between these two services be maintained at all times. In the event of an emergency situation, an emergency vehicle responding to the emergency must be given priority over all other surface movement traffic. Once an accident has occurred, the direction and control of the RFF operation must be left to the airport fire service officer-in-charge. The procedure of the emergency organization should provide for the rendezvous point(s) and staging area(s) to be used by the assisting services involved.

9.5.10 A rendezvous point is a prearranged reference point, i.e. road junction, crossroad or other specified place, to which personnel/vehicles responding to an emergency situation initially proceed to receive directions to staging areas and/or the accident/incident site. It is recommended that a process be established to assist responding external agencies with directions to the designated rendezvous point. A staging area is a prearranged, strategically placed area, where support response personnel, vehicles and other equipment can be held in readiness for use during an emergency.

9.5.11 Normally, one of the staging areas is located in the vicinity of the fire station. Upon notification from air traffic control announcing an aircraft emergency, the required equipment is dispatched to the scene of the accident or to the predetermined standby positions. Once the call has been received, all subsequent RFF action will be the responsibility of the airport RFF service officer-in-charge.

9.5.12 As airports experience few incidents and accidents, there are a larger number of standbys to cover movements of aircraft in circumstances where the possibility of an accident may reasonably be anticipated. Therefore, continual disaster / emergency training by airport responders should be conducted to ensure that both personnel and equipment will be capable in dealing with a major aircraft fire should the necessity arise.

9.5.13 The core training programme can be organized into nine faculties as follows:

1. Fire dynamics, toxicity and basic first aid;
2. Extinguishing agents and firefighting techniques;
3. Handling of vehicles, vessels and equipment;
4. Airfield layout and aircraft construction;
5. Operational tactics and manoeuvres;
6. Emergency communication;
7. Leadership performance;
8. Physical fitness; and
9. Auxiliary modules (e.g., rescue in difficult terrain, response to biological/chemical threats, etc.).

9.5.14 It is required that a maintenance programme, including preventive maintenance where appropriate, shall be established to maintain facilities in a condition which does not impair the safety, regularity or efficiency of air navigation.

9.5.15 Due to the ever-increasing complexity of specialized aviation fire vehicles and their associated rescue equipment, a programme of regular and ongoing preventive maintenance is paramount to ensure availability and reliability. A robust maintenance programme would also maximize the lifecycle of both fire vehicles and rescue equipment.

9.5.16 The subject of human factors is about people. It is about people in their working and living environments. It is about their relationship with equipment, procedures and the environment. Just as importantly, it is about their relationships with other people. Human Factors involve the overall performance of human beings within the aviation system; it seeks to optimize people's performance through the systematic application of the human sciences, often integrated within the framework of system engineering. Its twin objectives can be seen as safety and efficiency. Human Factors is essentially a multidisciplinary field, including but not limited to: psychology; engineering; physiology; sociology; and anthropometry. Indeed, it is this multidisciplinary nature and the overlapping of the constituent disciplines that make a comprehensive definition of Human Factors difficult.

9.5.17 Study Reports – Rescue Firefighting (RFF) Response

9.5.17.1 Addis Ababa Bole International Airport works closely with the municipality on RFF response. An MOU between the airport and the city has been signed, and the hotline for emergencies is operational. The periodicity of emergency exercise is in accordance with ICAO requirement. Such exercises are coordinated with all concerned stakeholders. There are requests on reciprocal basis between the airport and the city for fire and rescue service. No event of aviation accident or incident occurred at the airport land side to date has required city fire and rescue service.

9.5.17.2 Nairobi City County plays the required role in safety assurance, emergency operations and rapid response arising from operations, accidents and incidents such as dangerous goods, hazardous materials at the landside of the **Jomo Kenyatta International and Wilson Airports** as well as metropolitan area.

9.5.17.3 ATC, military, metropolitan authority, KCAA, KAA, concerned private institutions and other stakeholders are members of the National Disaster Committee. JKIA and Wilson Airport have their own contingency emergency plans which have been developed and implemented in line with the aerodrome certification requirements.

9.5.17.4 OR Tambo and Lanseria International Airports coordinate efforts within the emergency management plans for fire and rescue through a joint operation centre. Exercises and training are conducted in accordance with ICAO requirements.

CHAPTER 10: CURRENT AND EMERGING CHALLENGES TO AVIATION

10.1 RPAS (Remotely Piloted Aircraft Systems)

10.1.1 RPAS may be operated from established aerodromes or from almost any other location depending on operational requirements and system configuration, design and performance. For operations from established aerodromes the following items should be considered:

- Regulations pertaining to RPAS operations on/near an aerodrome;
- Complexity and density of aircraft operations;
- Ground operations;
- Payload consideration;
- Wake turbulence;
- Performance and capability related to take-off distance/run available and minimum obstruction climb requirements, departure procedures and any flight restricting conditions associated with operations to/from the aerodrome; and,
- Availability of emergency recovery areas

10.1.2 RPAS operations in the proximity of aerodromes may include control of birds or inspection of facilities. These types of operation should be regulated to ensure safety and avoid conflict with other aerodrome users.

10.1.3 Unregulated UAS or drones used for recreational purposes have been identified as a potential major hazard for manned aircraft, especially when operated inappropriately in the vicinity of aerodromes. Regulation of this activity should be undertaken as a matter of urgency by States, supported by widespread education campaigns. ICAO is developing guidance material and best practices to assist States in this effort.

10.1.4 Study Airports - RPAS

10.1.4.1 The development of a regulation of RPAS in South Africa and Kenya is at an advanced stage. Meanwhile, ICAO guidance is applied to address matters concerning RPAS at the national level. The development of regulations is under process in Ethiopia to govern operations of drones. When the need arises, ECAA coordinates with specific government organizations including the army to provide necessary permits.

10.1.5 Non-regulated hard and soft obstacles within South African airspace are always reported by pilots and air traffic controllers. They include laser beams, RPAS and Chinese Lanterns. The enforcement is made through policing including the use of helicopters in order to intercept people engaged in the violation of the airspace and their devices. It is recognized that the enforcement often is very difficult since some obstacles are smaller and cannot always be identified on radar. However, a city has no mandate to regulate these obstacles rather join efforts for enforcement.

10.1.6 The international civil aviation community may need to consider the installation of GPS control systems to prevent airspace infringement by RPAS. Commercial activities are well controlled, the coordination between SACAA and metro is foreseen

10.2 Laser Beam

10.2.1 Laser illumination can induce spatial disorientation and loss of situational awareness of pilots, causing a direct threat to safety of flight. Protected flight zones need to be established at the vicinity of airports where the use of laser beams is restricted. Stakeholders should be sensitized on filing a proper request for authorization to competent aviation authorities when they intend to carry out a laser activity near airports.

10.2.2 Laser is an acronym for light amplification by stimulated emission of radiation; this technique can produce a beam of light of such intensity that can cause bio-effects, even at distances of over 10 km. These bio-effects may include:

- a) Distraction;
- b) Glare (also referred to as dazzle);
- c) Flash-blindness;
- d) After-images;
- e) Scotomas;
- f) Retinal burns;
- g) Retinal haemorrhages;
- h) Globe rupture; and,
- i) Others.

10.2.3 Obvious flight safety risks are associated with laser beam illumination during critical phases of flight (especially procedures requiring steady-state turns) There are two situations where outdoor laser operations may compromise aviation safety. The first is where the MPE is exceeded and physical injury to the eye can occur. The second is the situation where the MPE is not exceeded, but where there is a potential for functional impairment, such as flash-blindness, after-image and glare that can interfere with the visual tasks of the pilots during critical phases of flight. To protect the safety of aviation in the vicinity of aerodromes, heliports and certain other areas, such as low-level VFR corridors, it is necessary to protect the affected airspace against hazardous laser beams. For non-visible laser beams, the NOHD value is the sole consideration. For visible laser beams, in addition to the NOHD, visual disruption must also be considered. Protected flight zones contain:

- a) Laser-beam critical flight zone (LCFZ)
- b) Laser-beam free flight zone (LFFZ)
- c) Laser-beam sensitive flight zone (LSFZ)
- d) Normal flight zone (NFZ)

10.2.4 Laser beams are potential causes of air traffic incidents. With urbanisation, the likelihood of pilots experiencing laser beams is high due to more human activities on the ground. Thus, flight paths should be with minimal or no human occupation to lessen incidents of laser beams and legislation should be enforced to ensure no one uses laser beams around airports. Careful planning of urban settlements would be necessary in this respect.

10.2.5 Study Airports – Laser Beams

10.2.5.1 To date no incidents related to laser beams have been reported around Addis Ababa Bole International Airport. Activities related to the use of laser beams are regulated by the Ethiopian Radiation Protection Authority.

10.2.5.2 It should also be noted that no incidents relating from laser beams have occurred around Jomo Kenyatta International Airport or Wilson Airport to date.

10.3 Rapid and Unplanned Urbanisation

10.3.1 Urban expansion has been a major impediment of airport space. Urban land users encroach airport facilities, causing the airport to be in a congested environment. Airports require space for flight paths that should be of limited or minimal activity. However, the growth and development of towns and cities result in urban population settling under flight paths. Land use around airports can impact the operational safety and efficiency of the airport, the safety of surrounding communities, and community exposure to the environmental effects of airport

operations. Thus, it is imperative that airport master plans and urban and regional land use plans be developed with these factors in mind. Community engagement provides a better understanding to the community of the cause and effects of changes to land use, should it be related to aeronautical or non-aeronautical activities.

10.3.2 The Airport Planning Manual – Part 2 – Land Use and Environmental Management, Chapter 5 provides guidance on Land use in the vicinity of airports: natural land use; agricultural land use; highways and railways; recreational land use; municipal utilities; commercial land use; industrial land use; and residential and institutional land use. As part of the manual, recent case studies of effective land use management around individual global airports is provided which outline: State land use planning; States best practices; unsuccessful practices; noise management plans and procedures, and ecological projects. These case studies provide an excellent review of current and future practices of global airports in promoting sustainable development, focusing on synergies between airports and communities.

10.3.2 Study Airports – Rapid and Unplanned Urbanisation

10.3.2.1 Rapid and unplanned urbanization has led to difficulty in acquiring more land for expansion of airports such as in Nairobi's Jomo Kenyatta International Airport.

10.3.2.2 Wilson Airport has been encroached by private developers and developments in the vicinity of the airports which are a major concern.

10.3.2.3 In Ethiopia and South Africa, the airport neighbourhood has been protected through strict access rights.

10.4 Incompatible/Unregulated Land Uses Around Airports and Other Aviation Facilities

10.4.1 Land uses close to airports could be a hindrance to aviation. The airport space needs low rise developments that do not impede the flight path, and of low rise nature to avoid blocking the landing and take-off flight paths.

10.4.2. Study Airports – Low Density Land Uses

10.4.2.1 Low density land uses are also desirable and this is evident in places such as Wilson Airport and JKIA where the Nairobi National Park forms a flight path, and a northerly flight path passing over large sections of public utility institutional land.

10.5 Diminishing Land Resources around airports and other aviation facilities

10.5.1 Airports grow with time and demand, thus expansion requires an increase in the plinth area of facilities in the airports. The expansion requires acquisition of more land for expansion. In the growing urban environment that has a high demand for space in the urban sector; diminishing land resources in the urban area prevent an airport from growing in size. Without a growth in aviation facilities, aviation growth would be impeded by the absence of support facilities and operations. Airport master planning and State and regional urban plans should be developed with identified challenges and opportunities. The plans need to be consulted with surrounding communities to ensure effective communication and coordination.

10.5.2 Study Airports – Growth Challenges

10.5.2.1 There are various growth challenges that have been faced at JKIA (while the airport authorities were seeking more land for the construction of a second runway) and Bole International

Airport. The Ethiopian Airports Enterprise is planning to build a new airport to replace Bole International Airport at a location outside the city to ease the congestion challenges facing the airport.

10.6 The City-Airport Connection

10.6.1 The transport link between cities and the airport need to be seamless to facilitate faster movement of goods, services and people between the city and airport. Transportation planning incorporating the needs of the airport and community are essential to establishing a corridor for both the airport and community.

10.6.2 Sufficient airport connections in terms of public transport and a modal split that does not congest the transport routes to the airport are crucial in enhancing and promoting seamless connectivity. Poor connections lead to delayed aviation activities and a slowdown in the passenger and cargo turnover in airports and impact local air quality.

10.6.3 Airlines prefer destinations with good connections to the city and good facilities such as hospitality facilities. These, in turn translate to more passengers and goods volumes that promote the aviation sector and the economy in general.

10.6.4 Study Airports – City-Airport Connection

10.6.4.1 **OR Tambo** has adequate connections to the airport, and airport users can access the airport within a short time. **Nairobi** and **Addis Ababa** however have a problem in accessing the airport due to traffic congestion of the routes leading to the airport, slowing down the access periods.

10.7 Government Policies and Strategies

10.7.1 Aviation is facilitated by the national government and supported by the local authority governments in terms of legislation, policies and programmes. This helps to protect the aviation space and boost aviation related activities.

10.7.2 However, some policies work against the aviation industry and impair its growth. In many African states, AFRAA reported heavy taxation as one of the major impediments to the growth of aviation. Governments heavily rely on taxing aviation goods and services to get money to develop other sectors of the economy, leaving the aviation sector heavily underfunded. Taxation costs are eventually passed down to the consumers who pay heavily for tickets and freight charges. This eventually leads to low passenger numbers and mostly, there are insufficient numbers to bolster a higher demand of goods and passengers. Thus, air transport thus remains a mostly expensive mode of travel in Africa, and is used by small numbers.

CHAPTER 11: ENVIRONMENT

11.1 General

11.1.1 Improving the environmental performance of aviation is a challenge ICAO takes very seriously. In fulfilling its responsibilities, the Organization developed a range of standards, policies and guidance material for the application of integrated measures to address aircraft noise and emissions, embracing technological improvements, operating procedures, proper organization of air traffic, appropriate airport land-use planning, the use of market-based options, and environmental management.

11.1.2 In 2004, ICAO adopted three major environmental goals, to:

- a) Limit or reduce the number of people affected by significant aircraft noise;
- b) Limit or reduce the impact of aviation emissions on local air quality; and
- c) Limit or reduce the impact of aviation greenhouse gas emissions on the global climate

11.1.3 ICAO documents which promulgate environmental standards and guidance include:

- a) Doc 9184 *Airport Planning Manual- Land Use and Environmental Management*;
- b) Doc 9829 *Guidance on the Balanced Approach to Aircraft Noise Management*
- c) ICAO Doc 9884 *Guidance on Aircraft Emissions Charges Related to Local Air Quality*
- d) ICAO Circular 351 *Community Engagement for Aviation Environmental Management*
- e) ICAO Doc 8168 *Procedures for Air Navigation Services- Aircraft Operations (PANS-OPS) Volumes 1&2*
- f) ICAO Doc 9931 *Continuous Descent Operations (CDO) Manual*
- g) ICAO Doc 9993 *Continuous Climb Operations (CCO) Manual*
- h) Doc 10031 *Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes*

11.1.4 ICAO publishes an environmental report every three years, sharing information on the progress made over the last three years across key areas of ICAO's environmental protection activities. It is a compendium of technical and scientific articles informs the public of the work of the ICAO Secretariat, ICAO Member States and the many other stakeholders involved. As such, it is considered as the reference document in the area of international aviation and the environment and captures all main developments in this field (<https://www.icao.int/environmental-protection/Pages/ENV2016.aspx>).

11.2 Aircraft Noise

Aircraft noise is the most significant cause of adverse community reaction related to the operation and expansion of airports. This is expected to remain the case in most regions of the world for the foreseeable future. Limiting or reducing the number of people affected by significant aircraft noise is therefore one of ICAO's main priorities and one of the Organization's key environmental goals. The main overarching ICAO policy on aircraft noise, which contains details on all the elements that can be employed to achieve noise reductions, is the Balanced Approach to Aircraft Noise Management. This can be found in the ICAO *Doc 9829, Guidance on the Balanced Approach to Aircraft Noise Management*.

The four elements of the Balanced Approach include:

1. The reduction of noise at source: Aircraft noise ("*noise at source*") has been controlled since the 1970s by the setting of noise limits for aircraft in the form Standards and Recommended Practices (SARPs) contained in [Annex 16 to the Convention on International Civil Aviation](#)

(the "*Chicago Convention*"). This continues to be the case today. Noise provisions appear in Volume I of Annex 16. The primary purpose of noise certification is to ensure that the latest available noise reduction technology is incorporated into aircraft design and that this is demonstrated by procedures that are relevant to day-to-day operations. This aims to ensure that noise reductions offered by technology are reflected in reductions around airports.

2. Land-use planning and management: Land-use planning and management is an effective means to ensure that the activities nearby airports are compatible with aviation. Its main goal is to minimize the population affected by aircraft noise by introducing land-use zoning around airports. Compatible land-use planning and management is also a vital instrument in ensuring that the gains achieved by the reduced noise of the latest generation of aircraft are not offset by further residential development around airports. ICAO guidance on this subject is contained in Annex 16, Volume I, Part IV and in the [ICAO Doc 9184, *Airport Planning Manual, Part 2 — Land Use and Environmental Management*](#). The manual provides guidance on the use of various tools for the minimization, control or prevention of the impact of aircraft noise in the vicinity of airports and describes the practices adopted for land-use planning and management by some States. Noise modelling is the basis for land-use planning and management and is used to develop noise maps that reflect the average sound exposure to aircraft around the airports. Noise contours are therefore defined in regular intervals (every 5dB or every 10 dB) and these maps can be produced for different times of exposure (day or night). Noise maps are key to the implementation of noise mitigation tools. Indeed, a zoning policy can be defined, that would identify a series of activities that are deemed compatible with various levels of noise exposure. Typically, industrial development would be considered as compatible with higher noise level exposure. These noise maps and related zoning policies are essential instruments for effective urban development on a territory that hosts an airport and urban planners and developers should integrate these tools in city master planning. Derived mitigation measures are building codes, noise insulation programmes, land acquisition and relocation, transaction assistance or real estate disclosure. This Guidance Document also entails recommendations for Heritage Conservation and Climate Change adaptation.
3. Noise abatement operational procedures: The way aircraft are operated in day-to-day operations may also present impacts in terms of the noise that reaches the ground. ICAO assists on the development and standardization of low noise operational procedures that are safe and cost-effective. The possibilities include noise preferential runways and routes and noise abatement procedures for take-off and landing. The appropriateness of any of these measures depends on the physical lay-out of the airport and its surroundings, but in all cases the procedure must give priority to safety considerations. ICAO's recommendations on operational procedures are contained in several documents:
 - i. [Doc 8168 \(*Procedures for Air Navigation Services — Aircraft Operations \(PANS-OPS\) Part I*\)](#) – provides guidance on noise preferential runways and routes, displaced thresholds, approach and landing operating procedures, and Noise Abatement Departure Procedures (NADPs).
 - ii. [Doc 8168 \(*Procedures for Air Navigation Services — Aircraft Operations \(PANS-OPS\) Part II*\)](#) – includes the consideration of noise aspects on the planning and definition of departure routes, including the compromise involved in concentrating or spreading aircraft noise with the routes definition.
 - iii. [Doc 9931 - *Continuous Descent Operations \(CDO\) Manual*](#) and [Doc 9993 - *Continuous Climb Operations \(CCO\) Manual*](#) provide guidance on CDO and CCO operations that may present benefits at both noise and emissions aspects.

- iv. [Doc 9888 – Noise Abatement Procedures: Review of Research, Development and Implementation Projects - Discussion of Survey Results](#) contains a summary of two surveys of key aviation stakeholders conducted in 2006 and 2008.
 - v. [Doc 10031 Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes](#) provides environmental assessment guidance to support sound and informed decision making when analyzing proposed air traffic management (ATM) operational changes.
4. Operating restrictions: Noise concerns have led some States to consider banning the operation of certain noisy aircraft at noise-sensitive airports. In the 1980s, the focus was on Non-Noise Certificated (NNC) aircraft; in the 1990s, it moved to Chapter 2 aircraft; today, it has moved to the noisiest Chapter 3 aircraft. However, operating restrictions of this kind can have significant economic implications for the airlines concerned, both those based in the States taking action and those based in other States that operate to and from the affected airports. On each occasion, the ICAO Assembly succeeded in reaching an agreement – contained in an Assembly resolution – that represented a careful balance between the interests of developing and developed States and took into account the concerns of the airline industry, airports and environmental interests. Apart from phase-out, other possible operational restrictions include curfews, night time restrictions, noise quotas/budgets, cap rules, non-addition rules, and restrictions related to the nature of flight.

11.2 Air Quality in The Vicinity Of Airports

11.2.1 Air quality in the vicinity of airports is affected by aircraft engine emissions, emissions from airport motor vehicles and access traffic, and emissions from other sources (e.g., heating/power plants and incinerators).

11.2.2 Since the late 1970s, ICAO has been developing measures to reduce the impact of aircraft emissions on Local Air Quality (LAQ). These measures focus on the effects of aircraft engine emissions released below 3,000 feet (915 metres) and emissions from airport sources, such as airport traffic, ground service equipment, and de-icing operations. One of the principal results arising from the work of ICAO is the development of the ICAO Standards and Recommended Practices (SARPs) on aircraft engine emissions contained in Volume II of Annex 16 to the Convention on International Civil Aviation (the “Chicago Convention”) and related guidance material and technical documentation. Among other issues, these provisions address: liquid fuel venting, smoke, and the main gaseous exhaust emissions from jet engines, namely; hydrocarbons (HC), oxides of nitrogen (NO_x), and carbon monoxide (CO). Specifically, the Annex 16 engine emissions Standards set limits on the amounts of gaseous emissions and smoke allowable in the exhaust of most civil aircraft engine types.

In addition, ICAO has issued specific guidance on LAQ emissions-related charges that appears in ICAO Doc 9884 *Guidance on Aircraft Emissions Charges Related to Local Air Quality*.

11.3 CO₂ Emissions from International Aviation

Resolution A39-2, adopted by the 39th ICAO Assembly in 2016, sets forth an overarching policy for the Organization to address the impacts of international aviation on the global climate. It affirmed the global aspirational goals for the international aviation sector of improving annual fuel efficiency by 2% and stabilizing the sectors’ global CO₂ emissions at 2020 levels (carbon neutral growth from 2020).

With a view to achieving the global goals and ultimately the sustainable future for international aviation, ICAO has made important progress, focusing on the development and implementation of

a “basket of mitigation measures” to reduce CO₂ emissions from international aviation. The “basket” includes advancements in aircraft technology, operational improvements, sustainable alternative fuels, and market-based measures.

Technology can play a major role in reducing emissions; aircraft produced today are about 80 percent more fuel efficient per passenger kilometre than in the 1960s. A major area of activity of the Organization in the field of aviation and climate change, is the development of Standards and Recommended Practices (SARPs), with a view to ensure that the latest technology is incorporated to aircraft. In particular, the adoption of a CO₂ emissions certification Standard for aeroplanes in 2017 has been one of the most challenging tasks being undertaken by the Organization under its Committee on Aviation Environmental Protection (CAEP). This new Standard, as the first global Standard for CO₂ emissions of any sector, will apply to new aeroplane type designs from 2020 and to aeroplane type designs that are already in-production in 2023.

Operational measures are also among the elements in the basket of measures available to States to reduce aviation CO₂ emissions. Improved operational measures defined in the ICAO Global Air Navigation Plan (GANP) reduce fuel consumption, and in turn, CO₂ emissions. For every tonne of fuel reduced, an equivalent amount of 3.16 tonnes of CO₂ are saved. For example, CAEP, in partnership with the operational community, has been assessing the environmental benefits of the Aviation System Block Updates (ASBUs), which is a major initiative to improve global air navigation efficiency.

Impressive progress in the development and deployment of sustainable alternative fuels for aviation has been achieved, including commercial flights using sustainable drop-in fuels from a variety of feedstocks and a number of aviation alternative fuel initiatives are currently underway worldwide. ICAO continues to be at the forefront in facilitating the timely availability of such fuels in sufficient quantities for use in aviation in a sustainable manner, supporting States and stakeholders in their efforts through its Global Framework for Aviation Alternative Fuels (<https://www.icao.int/environmental-protection/GFAAF/Pages/default.aspx>) and the adoption of 2050 ICAO Vision on Sustainable Alternative Fuels for International Aviation, as requested by Assembly Resolution A39-2.

Last but not least, the 39th Session of the ICAO Assembly adopted a historic Resolution, Resolution A39-3, which marked the decision to implement a Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) as a means to complement the other measures of the basket of measures to achieve the global aspirational goal of carbon-neutral growth from 2020.

As in paragraph 9 of the Assembly Resolution, the CORSIA is implemented in phases, starting with participation of States on a voluntary basis, followed by participation of all States except the States exempted from offsetting requirements, as follows:

- Pilot phase (from 2021 through 2023) and first phase (from 2024 through 2026) would apply to States that have volunteered to participate in the scheme; and
- Second phase (from 2027 through 2035) would apply to all States that have an individual share of international aviation activities in RTKs in year 2018 above 0.5 per cent of total RTKs or whose cumulative share in the list of States from the highest to the lowest amount of RTKs reaches 90 per cent of total RTKs, except Least Developed Countries (LDCs), Small Island Developing States (SIDS) and Landlocked Developing Countries (LLDCs) unless they volunteer to participate in this phase.

As of 11 January 2018, 73 States, representing 87.7% of international aviation activity, intend to voluntarily participate in the global MBM scheme from its outset (<https://www.icao.int/environmental-protection/Pages/market-based-measures.aspx>).

The Airport Planning Manual, Part 2, Land Use and Environmental Management, provides guidance on environmental aspects including local air quality and noise. However continual improvement in the management of other land use and environmental aspects is also identified. These management issues include water and soil pollution, waste management; environmental emergencies, environmental impact assessments; energy management; infrastructure development; and transportation management. These issues and aspects can be effectively managed through site environmental management systems, which have as a core principle continual improvement.

CHAPTER 12: TOWARDS A SUSTAINABLE URBAN AND AIRPORT DEVELOPMENT

Sustainable airport and urban development should give consideration to the following three pillars: social, economic and the environment. The implementation of these three pillars at the local community level, at regional level and at national level will encourage synergies between the airport and surrounding communities. Urbanization in Africa has been a crucial tool that has brought opportunities to provide basic needs and services to urban dwellers in Africa at affordable costs, and has been a major driver of development. Majority of most countries' GDPs were generated in urban areas. In Kenya for instance, Nairobi has been contributing more than 50% to the country's GDP. Forces that come to interplay in the urban areas create conducive growth synergies that can be harnessed to promote sustainable urban growth.

Reform in urban and territorial planning and development needs to be bolstered using evidence, adequate legal and policy documents, promotion of implementable institutional reform, responsible decentralization of urban services, promotion of co-operation with and among urban development partners, tailored made capacity building at the urban management level, closing of the inequality gap and urban governance. These will ultimately lead to more sustainable urban settlements, which are compact, resilient to climate change, responsive to human rights, and be more connected.

Integration of airport infrastructure development and aviation development are an entry point in promoting sustainable growth of the urban and aviation sectors. A collaborative effort towards harmonizing top-down regulatory frameworks and bottom-up national and city level urban growth regulations, policies and programmes must be well articulated and enhanced by all stakeholders in the urban and aviation sectors to ensure sustainable urbanization to realize synergies and meet the targets set out in the Sustainable Development Goals.

12.1 Convergence of Airport and Metropolitan Planning Policies

12.1.1 To create the synergy between airport and urban development for sustainable development in implementing the SDGs under the 2030 Agenda, aviation and metropolitan authorities are required to develop necessary infrastructure which will enable to meet the demand of the growing urban population and the air traffic. ICAO and UN-Habitat are engaged in fostering this projected growth in a sustainable manner by respectively putting in place “*No Country Left Behind*” and “*Leave No One Behind*” initiatives. These two initiatives respectively provide the way forward to fully implement the Strategic Objectives by ICAO on one hand, and urban settlement resilience under the New Urban Agenda by UN-Habitat on another.

12.1.2 Their complementary needs development of a framework that highlights the role of airports and cities in terms of infrastructure and services development in the city and around the airport; and a study of the synergistic relations to sustainable development. The development of infrastructure plays a key role in providing adequate services. The trends in land use around the airport may determine the impact on airports and air traffic capacity. In this regard land use should be in compliance with land use changes and urban planning regulations and in alignment with the Airport Planning Manual Part 2, Land-Use and Environmental Management; socio-economic development plans, and ecological programmes for sustainable urban growth.

12.1.3 The cities considered in this pilot project have different approaches in articulating the development between airports and urban settlements. All airports implement equally ICAO SARPs and policies related to infrastructure development and land use planning as part of the national civil aviation regulations. Cities are guided by urban policies and procedures, and State and urban regional requirements. The current synergy between airports and urban development includes infrastructure development that is governed by stand-alone policies which make difficult joint oversight activities at the local and national level.

12.1.4 This situation lowers the expected economic sustainability. As a result, there is a need for ICAO and UN-Habitat to perceive the fostering of airports and metropolitan policies convergence by developing global guidelines with respect to their mandate and responsibilities that would assist States to establish sustainable approaches for new airport infrastructure and urban development. The national common policy will be of capital importance in contributing to optimal planning and implementation of development of infrastructure in line with the principles of sustainable development. The guidelines could address, for example, matters related to airports and metropolitan infrastructure development, land-use planning and management, environment and capacity building as well as community engagement, without duplicating existing international guidance.

12.2 Capacity Building Priority and Training Needs

12.2.1 International civil aviation's greatest priorities over the coming decades virtually all derive from the projected doubling of the network's capacity while minimizing the associated environmental impacts and ensuring a sustainable and resilient air transport system. The shortage of pilots, air traffic controllers, engineers, and mechanics facing the global aviation industry, as well as the need to accelerate training and certification for these aviation professionals, including new managers who will need to lead them, are key areas where ICAO's leadership and action will be instrumental to the future viability and sustainability of our global network.

12.2.2 ICAO's NGAP programme is progressing to help States implement best practices for attracting and developing the large numbers of pilots, air traffic controllers, aircraft technicians, and other skilled individuals who will be needed to operate, manage, and maintain the growing air transport system in an environmentally sustainable manner.

12.2.3 The programme vision is described as a global aviation community that has sufficient competent human resources to support a safe, secure, and environmentally sustainable air transportation system. To achieve that vision, the NGAP mission is to develop strategies, best practices, tools, standards, and guidelines as applicable and to facilitate information sharing activities that assist the global aviation community in attracting, training, educating, and retaining the next generation of aviation professionals, in cooperation with the relevant ICAO Bureaus.

12.2.4 ICAO clearly recognizes the importance of effective human resources planning and development, in order to ensure sufficient numbers of skilled aviation professionals to meet projected future needs. Aviation is an intensely technological sector that requires vast numbers of skilled and dedicated professionals globally to ensure system safety and efficiency levels.

12.2.5 Engaging and empowering women and youth to pursue technically challenging skilled aviation careers is a key global priority for ICAO under its Next Generation of Aviation Professionals (NGAP) Programme. Trainair Plus is a cooperative network of training organizations and industry partners working together to develop and deliver an ICAO-harmonized package.

12.2.6 Measures should be taken to establish research and development institutions focusing on civil aviation and metropolitans at national and regional levels. States should facilitate and assist the civil aviation and metropolitan training centres to engage in collaborative arrangements with both national and international universities and research institutes to keep abreast with the technological and scientific advancements in the industry.

12.2.7 The three countries of Ethiopia, Kenya, and South Africa have established ICAO RTCEs which are members of TRAINAIR PLUS, and are seriously engaged in awareness campaigns to attract the younger generation to aviation and metropolitan professions. In regards to aviation, the younger generation work force is usually achieved through exposure, radio, conferences and joint aviation awareness programmes to reach people.

12.2.8 In South Africa, special attention is given to remote areas in order to ensure the same level of awareness and maturity with the urban population. Dedicated aviation career awareness programmes are implemented throughout the year in South Africa. The flagship project which is International Civil Aviation Day, celebrated on 7 December, is conducted on a rotational basis in each province. There are well organized associations for awareness activities and projects such as *Vulindlela* which play a significant role in exposing the youth to new economic developments in the country.

12.2.9 To integrate airport facility planning and city planning, a strong coordination between the national planning agencies, city and regional planning authorities and communities is required to ensure all planning laws and regulations are abided at the urban planning and airport planning level, ensuring the acceptance of the local population. City managers and airport managers need to be sensitized on the interagency co-operation needed in this regard.

12.2.10 The IG-UTP provides an extensive framework that if localized, will ease the planning of all aspects of the city. Training of city planners in adjusting the existing international guidelines to local circumstances while being fully compliant with their substance, will help in integrating the planning process at the urban level, regional level, and national level.

12.3 Conclusions and Recommendations

12.3.1 ICAO and UN-Habitat should consider establishing mechanisms to develop further guidelines, respecting existing international SARPs and guidance, and building upon their respective expertise, that would assist States to establish sustainable approaches for new airport infrastructure and urban development.

12.3.2 There is need to develop joint capacity development program for both airport and city planners. It is recommended that a partnership be considered to launch a tailor-made airport and urban planning course in full coordination with with ICAO.

12.3.3 City planners and urban policy makers should be sensitized on land use development and operational needs of aerodromes, airports and civil aviation infrastructure in the context of fast growing cities and urbanization taking into account ICAO policies and Standards and Recommended Practices governing land use and environmental management.

12.3.4 In order to gauge the economic dividends of aviation on urbanisation, ICAO, UN-Habitat and other interested stakeholders should consider in the long term, the development of tools and mechanisms to assess /quantify the socio-economic contribution of airports to cities and national development (using case studies) and vice versa.

12.3.5 UN-Habitat should also engage partners such as academic institutions to undertake evidence based research on spatial interactions between airport and city planning and development taking into account ICAO Policies as well as Standards and Recommended Practices.

12.3.6 Existing tools/regulations and comprehensive environmental impact assessments should be used to identify hazard and assess risks outside the airports (settlements, building, waste, landfills, smoke, etc.) and on city, with the view to eliminate and/or mitigate the consequences to the future developments, maximum utilization and realization of the intended benefits. Challenges and opportunities in land use and environmental management will contribute to the synergies of sustainable development.

12.3.7 Guidelines should include institutional coordination and governance model/framework for airport and city authorities' collaboration/ cooperation.

12.3.8 Promotion should be made to foster integrated Multi Modal Transports between airports (airports and airports) and between the airport and the city.

12.3.9 There is need to encourage States to engage in a programme between airports and city authorities to ensure that State Aviation and Urban Development Initiative is evaluated.

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APPENDICES

GLOSSARY OF TERMS AND ABBREVIATIONS

2030 Agenda	UN 2030 Agenda for Sustainable Development
A39	39th Session of ICAO Assembly
AASA	Airlines Association of Southern Africa
ACI	Airports Council International
ACSA	Airports Company South Africa
AFCAC	African Civil Aviation Commission
AFRAA	African Airlines Association
AGA	Aerodromes and Ground Aids
AIP	Aeronautical Information Publication
Annex	Annex to the International Civil Aviation Convention (Chicago Convention)
ATC	Air Traffic Control
ATNS	Air Traffic Navigation Services (South Africa)
AU	African Union
CCO	Continuous Climb Operation
CDO	Continuous Descent Operation
CEANS	Conference on the Economics of Airports and Air Navigation Services
CNS	Communication Navigation Surveillance
CO2	Carbon Dioxide
Doc	ICAO document
DVOR	Doppler Very High Frequency Omni-Directional Radio Range
EAE	Ethiopian Airports Enterprise
ECAA	Ethiopian Civil Aviation Authority
EI	Effective Implementation
ET	Ethiopian Airline
FDI	Foreign Direct Investment
FF – ICE	Flight and Flow Information Collaborative Environment
GDARD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
GMBM	Global Market-Based Measure
GPS	Global Positioning System
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICT	Information and Communications Technology
IHR	International Health Regulations
IPoA	Istanbul Programme of Action
KAA	Kenya Airports Authority
KCAA	Kenya Civil Aviation Authority
KQ	Kenya Airways
LAQ	Local Air Quality
LCFZ	Laser-beam Critical Flight Zone
LDCs	Least Developing Countries
LFFZ	Laser-beam Free Flight Zone
LLDCs	Landlocked Developing Countries
LSFZ	Laser-beam Sensitive Flight Zone
MOU	Memorandum of Understanding
MPE	Maximum Permissible Exposure
NASC	National Aviation Security Committee (South Africa)
NFZ	Normal Flight Zone

NGAP	Next Generation of Aviation Professionals
NOHD	Nominal Ocular Hazard Distance
ODA	Official Development Assistance
ORTIA	Oliver Reginald Tambo International Airport
PBN	Performance Based Navigation
RECs	Regional Economic Communities
RFF	Rescue and Firefighting
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft Systems
RTCE	ICAO Regional Training Centre of Excellence
SACAA	South African Civil Aviation Authority
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SPLUMA	Spatial Planning Land Use Management Act (South Africa)
TRAINAIR PLUS	ICAO Trainair Plus Programme
UAS	Unmanned Aircraft System
UN	United Nations
UN-Habitat	United Nations Human Settlements Programme
USOAP	Universal Safety Oversight Audit Programme
VFR	Visual Flight Rules
VHF	Very High Frequency
VPoA	Vienna Programme of Action
WHO	World Health Organization
WSPs	Water Safety Plans
YD	Yamoussoukro Decision

Aircraft and Passenger numbers

Table 4: Aircraft movement and passenger traffic at Addis Ababa Bole International Airport

Addis Ababa Bole International Airport													
Item	Movement		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Commercial Aircraft	Domestic	Total	7,351	7,070	7,332	7,382	8,283	8,661	10,176	12,791	14,423	17,683	
	International	Total	20,482	23,904	25,848	27,791	33,063	40,193	43,549	48,137	49,174	55,270	
	Total			27,833	30,974	33,180	35,173	41,346	48,854	53,725	60,928	63,597	72,953
Non Commercial	Both Domestic and International	Total	12,164	13,843	16,104	13,884	12,424	13,926	12,728	9,409	10,624	10,130	
Commercial and Non Commercial Aircraft		Grand Total	39,997	44,817	49,284	49,057	53,770	62,780	66,453	70,337	74,221	83,083	
Passengers	Domestic	Arrivals	46,296	150,572	146,296	150,572	176,456	182,984	208,726	260,053	307,142	357,903	
		Departures	37,705	148,579	137,705	148,579	175,759	182,305	207,775	263,629	302,286	359,152	
		Total	284,001	299,151	284,001	299,151	352,215	365,289	416,501	523,682	609,428	717,055	
	International	Arrivals	995,840	1,243,535	1,466,637	1,587,769	1,813,208	2,228,241	2,408,988	2,938,390	3,130,866	3,372,898	
		Departures	1,007,703	1,290,076	1,506,766	1,598,914	1,811,656	2,329,827	2,635,139	2,906,578	2,954,564	3,262,308	
		Total	2,003,543	2,533,611	2,973,403	3,186,683	3,624,864	4,558,068	5,044,127	5,844,968	6,085,430	6,635,206	
			Total arrivals	1,142,136	1,394,107	1,612,933	1,738,341	1,989,664	2,411,225	2,617,714	3,198,443	3,438,008	3,730,801
			Total departures	1,145,408	1,438,655	1,644,471	1,747,493	1,987,415	2,512,132	2,842,914	3,170,207	3,256,850	3,621,460
			Transit	459,144	470,360	625,014	751,806	917,140	1,288,084	1,463,172	1,769,071	2,113,284	1,456,816
			Total	2,287,544	2,832,762	3,257,404	3,485,834	3,977,079	4,923,357	5,460,628	6,368,650	6,694,858	7,352,261

Source: ECAA

Table 5: Aircraft movement and passenger traffic at Jomo Kenyatta International Airport

Item	Movement		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Aircraft	Domestic	Landings	58,229	71,659	63,957	65,979	77,650	88,775	89,071	87,457	89,820	88,468
		Take-offs	58,201	71,137	63,335	64,258	75,626	86,107	86,975	83,484	86,870	88,739
		Total	116,430	142,796	127,292	130,237	153,276	174,882	176,046	170,941	176,690	177,207
	International	Landings	37,804	35,715	33,363	34,619	39,011	44,198	43,699	42,935	45,602	43,689
		Take-offs	37,745	36,560	34,213	36,479	40,956	46,639	44,919	45,528	47,893	43,061
		Total	75,549	72,275	67,576	71,098	79,967	90,837	88,618	88,463	93,495	86,750
		Total Landings	96,033	107,374	97,320	100,598	116,661	132,973	132,770	130,392	135,422	132,157
		Total Take-offs	95,946	107,697	97,548	100,737	116,582	132,746	131,894	129,012	134,763	131,800
		Total	191,979	215,071	194,868	201,335	233,243	265,719	264,664	259,404	270,185	263,957
Passengers	Domestic	Arrivals	932,011	1,152,283	1,074,434	1,137,418	1,233,178	1,502,165	1,464,304	1,416,531	1,693,762	1,833,115
		Departures	834,944	1,080,126	1,050,972	1,045,285	1,096,831	1,330,588	1,269,859	1,187,883	1,445,269	1,560,476
		Total	1,766,956	2,232,409	2,125,406	2,182,703	2,330,009	2,832,753	2,734,163	2,604,414	3,139,031	3,393,591
	International	Arrivals	2,206,654	2,337,879	2,066,426	2,246,074	2,488,782	2,760,431	2,698,641	2,626,479	2,709,794	2,657,137
		Departures	1,309,249	1,391,492	1,081,341	1,299,655	1,435,989	1,649,207	1,693,632	1,632,291	1,728,122	1,519,526
		Total	3,515,902	3,729,371	3,147,767	3,545,729	3,924,771	4,409,638	4,392,273	4,258,770	4,437,916	4,176,663
		Total arrivals	3,138,665	3,490,162	3,140,860	3,383,492	3,721,960	4,262,596	4,162,945	4,043,010	4,403,556	4,490,252
		Total departures	2,144,193	2,471,618	2,132,313	2,344,940	2,532,820	2,979,795	2,963,491	2,820,174	3,173,391	3,080,002
		Transit	1,041,137	1,077,367	1,102,837	1,159,761	1,302,670	1,479,311	1,457,411	1,368,343	1,305,123	1,395,514
		Total	6,323,995	7,039,147	6,376,010	6,888,193	7,557,450	8,721,702	8,583,847	8,231,527	8,882,070	8,965,768

Source: KCAA

Table 6: Aircraft movement and passenger traffic at OR Tambo International Airport

Item	Movement		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Aircraft	Domestic	Landings	56,385	60,714	56,179	52,212	52,440	53,035	49,328	47,273	51,190	54,377	
		Take-offs	56,781	61,087	56,468	52,297	52,510	53,223	49,929	47,411	51,360	54,688	
		Total	113,166	121,801	112,647	104,509	104,950	106,258	99,257	94,684	102,550	109,065	
	International	Landings	35,292	38,793	39,592	39,331	41,009	42,522	42,327	43,681	43,858	43,803	
		Take-offs	34,061	37,203	37,656	37,721	40,691	41,043	41,080	41,107	43,156	43,809	
		Total	69,353	75,996	77,248	77,052	81,700	83,565	83,407	84,788	87,014	87,612	
		Total Landings	91,677	99,507	95,771	91,543	93,449	95,557	91,655	90,954	95,048	98,180	
		Total Take-offs	90,842	98,290	94,124	90,018	93,201	94,266	91,009	88,518	94,516	98,497	
		Total	182,519	197,797	189,895	181,561	186,650	189,823	182,664	179,472	189,564	196,677	
	Passengers	Domestic	Arrivals	4,864,830	5,517,173	4,942,770	4,617,320	4,770,486	4,989,442	4,798,546	4,631,892	4,686,727	5,157,884
			Departures	4,438,736	5,060,167	4,615,596	4,218,073	4,402,751	4,978,316	4,795,861	4,633,898	4,691,252	5,149,505
Total			9,303,566	10,577,340	9,558,366	8,835,393	9,173,237	9,967,758	9,594,407	9,265,790	9,377,979	10,307,389	
International		Arrivals	3,706,355	4,085,679	4,137,161	4,040,943	4,308,013	4,428,860	4,499,286	4,713,022	4,755,895	4,759,438	
		Departures	3,730,240	4,129,006	4,257,325	4,105,865	4,366,815	4,441,674	4,504,646	4,720,102	4,796,444	4,813,410	
		Total	7,436,595	8,214,685	8,394,486	8,146,808	8,674,828	8,870,534	9,003,932	9,433,124	9,552,339	9,572,848	
		Total arrivals	8,571,185	9,602,852	9,079,931	8,658,263	9,078,499	9,418,302	9,297,832	9,344,914	9,442,622	9,917,322	
		Total departures	8,168,976	9,189,173	8,872,921	8,323,938	8,769,566	9,419,990	9,300,507	9,354,000	9,487,696	9,962,915	
		Transit						n/a	n/a	n/a	n/a	991,732	
		Total	16,740,161	18,792,025	17,952,852	16,982,201	17,848,065	18,838,292	18,598,339	18,698,914	18,930,318	19,880,237	

Source: SACAA

Table 7: Aircraft movement and passenger traffic at Lanseria International Airport

Item	Movement		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Aircraft (NB This excludes helicopters and training flights)	Domestic	Landings	14,310	15,438	15,290	14,966	16,887	18,175	19,364	18,836	19,354	18,346
		Take-offs	14,086	15,181	15,176	14,635	16,616	17,997	19,026	18,553	18,962	18,000
		Total	28,396	30,619	30,466	29,601	33,503	36,172	38,390	37,389	38,316	36,346
	International	Landings	5,586	6,515	6,970	5,590	5,726	5,976	5,717	5,090	4,562	4,336
		Take-offs	5,573	6,623	7,063	5,778	5,841	6,084	5,847	5,216	4,905	4,609
		Total	11,159	13,138	14,033	11,368	11,567	12,060	11,564	10,306	9,467	8,945
		Total Landings	19,896	21,953	22,260	20,556	22,613	24,151	25,081	23,926	23,916	22,682
		Total Take-offs	19,659	21,804	22,239	20,413	22,457	24,081	24,873	23,769	23,867	22,609
		Total	39,555	43,757	44,499	40,969	45,070	48,232	49,954	47,695	47,783	45,291
	Passengers	Domestic	Arrivals	65,662	106,622	247,333	360,297	535,749	706,500	792,825	832,468	816,407
Departures			65,609	107,083	247,468	359,814	539,542	709,303	791,300	834,729	827,985	828,024
Total			131,271	213,705	494,801	720,111	1,075,291	1,415,803	1,584,125	1,667,197	1,644,392	1,650,271
International		Arrivals	18,993	25,728	31,592	22,315	21,227	24,086	21,881	19,855	15,059	15,316
		Departures	18,645	24,939	32,189	22,650	21,565	24,960	20,746	17,715	16,473	16,703
		Total	37,638	50,667	63,781	44,965	42,792	49,046	42,627	37,570	31,532	32,019
		Total arrivals	84,655	132,350	278,925	382,612	556,976	730,586	814,706	852,323	831,466	837,563
		Total departures	84,254	132,022	279,657	382,464	561,107	734,263	812,046	852,444	844,458	844,727
		Transit	-	-	-	-	-	-	-	-	-	-
		Total	168,909	264,372	558,582	765,076	1,118,083	1,464,849	1,626,752	1,704,767	1,675,924	1,682,290

Source: SACA

Table 8: Relationship between ICAO Strategic Objectives and Sustainable Development Goals

UN SDG		ICAO STRATEGIC OBJECTIVE *				
		SAFETY	CAP/EFF	SEC/FAL	ECON DEV	ENV
1	End poverty in all its forms everywhere					
2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture					
3	Ensure healthy lives and promote well-being for all at all ages					
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all					
5	Achieve gender equality and empower all women and girls					
6	Ensure availability and sustainable management of water and sanitation for all					
7	Ensure access to affordable, reliable, sustainable and modern energy for all					
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all					

9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation					
10	Reduce inequality within and among countries					
11	Make cities and human settlements inclusive, safe, resilient and sustainable					
12	Ensure sustainable consumption and production patterns					
13	Take urgent action to combat climate change and its impacts					
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development					
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss					
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels					
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development					

ICAO’s Strategic Objectives are strongly linked to 15 of the 17 United Nations Sustainable Development Goals (SDGs). The Organization is fully committed to work in close cooperation with States and other UN Bodies to support related targets.

ICAO is also an official observer on the *Inter-agency and Expert Group on Sustainable Development Goal Indicators* and is the custodian agency of global indicator 9.1.2 Passenger and Freight Volumes, by Mode of Transport within the 2030 Agenda framework. ICAO continuously contributes to monitoring efforts of the 2030 Agenda and other development frameworks as appropriate.

By clicking on any square of the table in the link below more information on each ICAO Strategic Objective's contribution to the United Nations Sustainable Development Goals will be displayed.

<https://www.icao.int/about-icao/aviation-development/Pages/SDG.aspx>

EGM PARTICIPANTS
Expert Group Meeting and Validation Workshop
Synergy between airports and Urban Development for Sustainable Development
UNON, Nairobi, Kenya, 29th –31st August 2016

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Back Cover Message

This report documents existing and potential areas of cooperation between the urban areas and aviation facilities; to enhance sustainable development.

The United Nations system works towards promotion of international peace and security, by promoting human welfare through environmentally friendly socio-economic development. The UN Agenda 2030 calls for a global partnership that brings together Governments, private sector, civil society, UN system and other actors to mobilize all available resources for its implementation. Accordingly, ICAO and UN-Habitat undertook to explore the '*Synergy between Cities and Airports for Sustainable Development*' to explore synergistic correlations between airports and urbanisation. This is because airports offer critical infrastructure and services in cities that inform the urban planning and development character. Airports also influence other development land-use options, which can be utilized to enhance economic returns and promote prosperity in cities, regions and countries, while limiting the impact on the environment. The goal is to enhance the process of steering airports and cities towards synergistic sustainability by deploying organic links to other sectors in the economy and integrating into the overall urban development agenda, in line with existing international standards and guidance.

South Africa (Southern Africa), Kenya and Ethiopia (Eastern Africa) were selected for this study. The regions account for the fastest urbanization rates and air passenger numbers (36%) in Africa. They have experienced steady growth around regional airport hubs in Johannesburg (Lanseria International Airport), Ekurhuleni (Oliver Tambo International Airport), Addis Ababa (Addis Ababa Bole International Airport) and Nairobi (Jomo Kenyatta International Airport and Wilson Airport). More people transit through these airports; eventually increasing the demand for goods and services consumed within and around the airports as well as supplying markets beyond the countries of origin. This has contributed to a large impact on employment and business opportunities; translating into socio economic growth locally, nationally, regionally, and globally due to the increased economic activities realized and other complementary effects on the economy.

Eastern Africa is the world's least urbanized region, but the fastest in urbanization sub-region in sub-Saharan Africa. Projections indicate that by the end of the current decade, the region's urban population will have increased by 50%; with the total number of urban dwellers by 2040 expected to be 5 times that of 2010. Southern Africa on the other hand, is the most urbanized region in sub-Saharan Africa, which is projected to reach an overall region-wide urban majority towards the end of the current decade. Angola, Botswana and the RSA have urban majorities in their population. The other countries, apart from Swaziland, are expected to reach that point by 2050. This urban growth scenario indicates that the sub-region will face severe impacts of rapid urbanization such as an increased demand for affordable sustainable housing, transportation infrastructure, and adequate generation of economic opportunities for the urban dwellers.

By visually examining, identifying and promoting synergistic relations between airports and urban areas with respect to environmental sustainability, this initiative aims at deploying organic links to other sectors in the economy and integrating all sectors of the urban economy into the overall development agenda to realize synergies and sustainability between aviation and urban development.