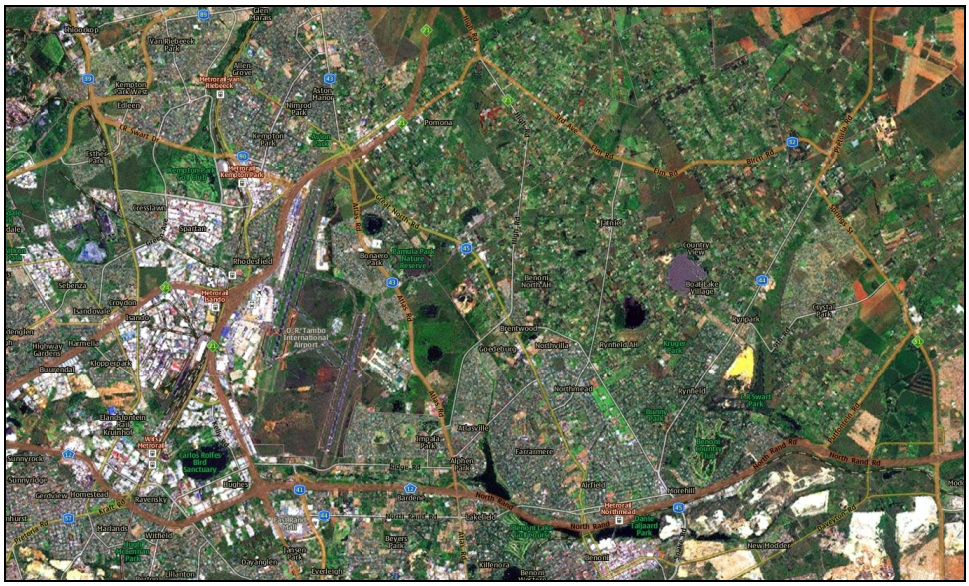
THE EKURHULENI AEROTROPOLIS:

Strategic Roadmap and Planning Guidelines



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Ekurhuleni
METROPOLITAN MUNICIPALITY

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Report prepared for the Ekurhuleni Metropolitan Municipality

NOTE: The following report, prepared under contract with Ekurhuleni Metropolitan Municipality (EMM), is intended for use as a strategic roadmap in the planning of logistics and commercial development on and around OR Tambo International Airport (ORTIA). It is not itself a formal planning document or business plan. Nor does it represent an official plan of ACSA, the EMM, or the greater Gauteng Province. All information contained in this report is deemed accurate but should be regarded as provisional pending rigorous reconfirmation. Although much of the data are from public sources, this document and its contents are privileged and confidential, meant only for internal use by the Ekurhuleni Metropolitan Municipality and not to be distributed to others.

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Introduction

The Aerotropolis Planning Model

A new strategic approach to airport planning and associated industrial and commercial land-use is gaining prominence around the world. This is the aerotropolis model[1]

Simply put, an aerotropolis is a city built around an airport offering its businesses speedy connectivity to their suppliers, customers and enterprise partners nationally and world-wide. These businesses, many in the high-tech and high-value service sectors, are often more dependent on distant suppliers and customers than those located in their own metropolitan region.

The aerotropolis also contains the full set of logistics and commercial facilities that support aviation-linked businesses and millions of air travelers who pass through the airport annually. These include, among others, forwarding, warehouse and distribution facilities; hotels, recreation, medical, convention, and exhibition complexes, and office buildings along with shopping, dining, and entertainment venues.

As an increasing number of aviation-oriented businesses and commercial service providers cluster around airports and outward along their highway corridors, the aerotropolis emerges where air travellers and locals alike work,

[1]See *www.aerotropolis.com*, and its publications links.

shop, meet, exchange knowledge, conduct business, eat, sleep, and are entertained without going more than 15 minutes from the airport. A new dynamic urban center forms, with multimodal transportation infrastructure (air, highway, rail, and links to ports) connecting businesses and people to markets near and far, undergirding the growing local, national, and global economic significance of the Aerotropolis.

Apropos the above, the U.S. Federal Aviation Administration defines an aerotropolis as a 'planned and coordinated multimodal freight and passenger transportation complex which provides efficient, cost-effective, sustainable, and intermodal connectivity to a defined region of economic significance centered around a major airport.'[2] Aerotropolis planning therefore spans land-use planning and transportation planning. More specifically, with respect to aerotropolis planning, land-use planning includes reconciling (1) the business site and profitability objectives of individual firms making capital investments, (2) airport and surface transportation planning objectives of ensuring maximal access to the airport and business sites at the lowest possible cost, and (3) the urban planning objectives of overall economic efficiency, aesthetic appeal, and social and environmental sustainability. With respect to transportation planning, aerotropolis planning also includes designing systems for efficient, secure cargo logistics and for safe personal mobility.

[2]Paraphrased slightly from [112nd] H.R.658 : FAA Air Transportation Modernization and Safety Improvement Act, 2011.]

Aerotropolis planning is unique in that business, urban, airport, and surface transport objectives noted above are addressed together to create economically efficient, attractive, and sustainable airport area development. This replaces the chaos, confusion, congestion and unsightliness evident at and around many major airports detracting from their image.

Integrated surface transportation planning around the airport is particularly important because people and product air journeys neither begin nor end at the passenger and cargo terminals. Passengers and cargo often spend considerable time, and expense, in getting to and from airports and in negotiating airport obstacles, creating "last mile" and "terminal" costs. Because "terminal" and "last mile" costs can be substantial whereas the marginal costs of flying an extra mile are often insignificant, those airports and surrounding areas which successfully minimize those costs are often able to enhance their economic competitiveness and therefore their attraction as a location for business investment.

Aerotropolis planning, therefore, differs from conventional airport planning by considering "inside the fence" terminal, mutually beneficial "outside-the-fence" development, and "last mile" costs holistically. We learned years ago that the battle for air freight—and thus the industries using air freight—is increasingly won on the ground through good surface accessibility. The same is true with passenger travel. For example, in the United States, more than

half the time spent on air journeys between Chicago's downtown and New York City's downtown is famously spent on the ground, locked in freeway gridlock, terminal congestion, or backed up on airport taxiways. Traffic congestion in Ekurhuleni can create similar adverse air-journey conditions. Particularly for flights of moderate length—the most common trajectory for business travel—such delays are not only onerous but they can also significantly impact the competitiveness of local firms and decrease a region's attractiveness as a business location destination. This is because shippers and passengers are increasingly making travel mode and route choices on the basis of the entire (surface and air) journey.

That reality reveals a second shortcoming of most airport and metropolitan municipal planning. Although integrated airport area land use and transportation planning is a valued ideal, in practice, that ideal is rarely achieved.

Stated a bit differently, while the aerotropolis represents an integrated coalition among the airport, its airlines, surrounding municipalities and the broader provincial region, master planning all too often remains silo-ed (fragmented) in airport planning, aviation-route planning, municipal and provincial transportation planning, and land-use planning at various territorial levels. Far less than optimal outcomes result for the airport, surrounding municipalities, and the broader region the airport serves.

As will be highlighted throughout this report, airport and aerotropolis surface infrastructure planning and land use planning are critical for the aesthetic, operational, and functional reasons. First, as the African continent's primary air gateway, OR Tambo International Airport (ORTIA)and its immediate environs set the initial and the final impressions of many distant travelers not just to the Ekurhuleni Metropolitan Municipality (EMM) and other major Gauteng Province municipalities such as Johannesburg and Pretoria (Tshwane), but for all of South Africa. Second, as previously noted, all air journeys are intermodal with the first and last legs almost always via a surface mode. Third, surface infrastructure helps anchor cargo users, freight forwarders, and other airport-oriented businesses. As a result,

- Appropriate airport and airport area land-use planning can increase the efficiency of ORTIA's passenger and cargo flows and improve the appearance and property values of the airport and surrounding airport area land.
- Improved road and rail infrastructure can expand the catchment area of ORTIA, attracting more passengers and cargo thereby supporting more flights.
- New and improved Ekurhuleni and Gauteng Province freight rail intermodal facilities connected to South African ports and nearby nations can anchor logistics and freight-dependent firms. Some of these also have air transportation needs, creating a possibility for cross-modal subsidization. Most importantly, multimodal logistics infrastructure could support both Ekurhuleni's and the Province's growth of high-tech manufacturing thereby diversifying and strengthening their economies.

- Commercial development on ORTIA (including its planned aerotropolis/airport city) can generate substantial non-aeronautical revenues for ACSA allowing it to support continuous modernization and infrastructure improvement of the airport while keeping its costs to airlines competitive through commercial revenue cross-subsidization of these costs.
- Commercial and logistics development beyond the airport can also generate additional passengers and cargo for ORTIA while providing amenities and attractions to ORTIA's passengers and value to cargo processing.
- This commercial and logistics development, if properly sited and supported by more efficient surface transportation infrastructure, will provide Ekurhuleni with a true urban center which boosts land values, attracts investment, creates jobs, and drives economic development throughout Ekurhuleni and the Gauteng Province.

Taken together, positive outcomes and others that the strategic guidelines in this report are meant to help achieve will go a long way to increasing ORTIA's benefits for its users, the EMM, Gauteng Province and, indeed, the nation. Following the strategies and planning guidelines herein should not only help ORTIA become a more efficient, profitable, and attractive airport, but also better leverage its aeronautical and non-aeronautical development to substantially strengthen the municipal, provincial and national economies it serves. New business investment, jobs, and greater prosperity for the EMM, Gauteng Province and South Africa should accrue.

In the four chapters which follow, I provide a strategic roadmap offering (1) the competitive logic and business rationale for following the new aerotropolis development model and present explicit cases of its implementation

around the world, (2) infrastructure and facility plan guidelines with focus on ORTIA and its surrounding areas, (3) business plan guidelines to assess demand, reduce risk and increase returns on investment, and (4) implementation guidelines and recommended actions to move the Ekurhuleni Aerotropolis and greater Gauteng Province forward.

In generating this report, I followed the scope of work in my contract with the EMM which specified the contents as follows:

A. The Global Context for the Ekurhuleni Aerotropolis
    1. Competitive logic and business realities shaping air logistics and aerotropolis development
    2. Key features of air logistics hubs, airport cities and aerotropolises evolving in the U.S., Europe, Asia, and the Middle East
    3. Economic impact and job creation at and around their airports
    4. Air logistics hub/aerotropolis successes and failures, and reasons
    5. Airport-driven commercial components (both inside and outside the airport fence)
    6. Ekurhuleni Aerotropolis potential credibility and viability, including transferability of the successful experiences in the U.S., Europe, Asia, and the Middle East
B. Ekurhuleni Aerotropolis Infrastructure and Facilities Design Guidelines
    1. Proposed Ekurhuleni air logistics hub and Aerotropolis infrastructure configuration
    2. Future OR Tambo and EMM cargo area and facilities design
    3. Ekurhuleni intermodal interfaces (air, highway, rail, and links to ports)
    4. Electronic data interchange (EDI) and IT system guidelines

5. Infrastructure and facility expandability, reconfigurability and phased growth
6. Designing for future tenant and business user needs of an ORTIA air logistics hub, airport city, and greater Ekurhuleni Aerotropolis

C. Ekurhuleni Aerotropolis Business Plan Guidelines

1. Creating an attractive business environment at and around ORTIA
2. Business resource needs (e.g., free trade zones, accelerated permitting)
3. Functional capabilities required and marketing principles
4. Recruitment of additional passenger and air cargo service to ORTIA
5. OR Tambo air logistics hub and Ekurhuleni Aerotropolis critical success factors
6. Ekurhuleni Aerotropolis target industries

D. OR Tambo Air Logistics Hub/Ekurhuleni Aerotropolis Implementation Plan Guidelines

1. Infrastructure phasing and development timetable
2. Providing appropriate investor incentives
3. Coordination and harmonization with key actors, governments, and organizations throughout the Province and with other airports
4. Placemaking and branding the Ekurhuleni Aerotropolis as a destination, including design standards
5. Institutional and management guidelines for air logistics hub/aerotropolis development & operation, including potential strategic investment and development partners
6. Recommendations and action steps for the successful development of an OR Tambo air logistics hub and surrounding Ekurhuleni Aerotropolis

Some minor modifications were made in the titles and order of the subsections to make the chapters flow better. The report contains substantial additional

information and sections beyond the scope of work that would benefit Ekurhuleni Aerotropolis planning. In particular, based on the industrial structure of the EMM and objective of Executive Mayor Mondli Gungubele to make fast-cycle logistics the municipality's competitive advantage in diversifying and growing its economy, I have addressed time-critical manufacturing, supply-chain management, and multimodal air cargo issues in much greater scope and depth. I also included considerable material on guidelines for generating commercial facility demand forecasts, competitor analysis, risk analysis and managing potential investors in the Ekurhuleni Aerotropolis. This has made the report larger than originally stipulated in the contract. Yet, I believe this additional work and content will provide greater value to the EMM and Gauteng Province in planning and implementing their multimodal logistics platforms as well as establishing the parameters and guidelines for a full-scale integrated Aerotropolis master plan.

Chapter 1

The Global Context for the Ekurhuleni Aerotropolis

Scenario
A Young Ekurhuleni Firm

The time:	A few years from now.
The place:	A recent Ekurhuleni start-up in precision manufacturing.
The mood:	Tense.
The reason:	A German customer is on the phone from Frankfurt. The voice is strained. The sophisticated machinery they ordered from the young Ekurhuleni start-up had arrived in Germany in good condition, but in the process of installation a delicate component was damaged. The damaged component is holding up production, costing the customer many thousands of Euros an hour. How soon could a replacement be provided? The fate of the young Ekurhuleni firm could hang in the balance.

1.1 Economic Challenges and Aerotropolis Opportunities

The above scenario is, of course, fictitious, but the situation is not. In an increasingly time-competitive economy, the survival and growth of many such firms will be determined by whether the response is "we can replace the part but we cannot get it to you immediately" or "we'll have the replacement on the plane to you tonight."

Ekurhuleni is striving to compete, diversify its economy, attract higher-value business investment and create more well-pay jobs in a marketplace totally different from its past. Once determined by natural endowments and by goods and services built upon those endowments, Ekurhuleni's 21st century economic fate will be much more shaped by the speed and agility of moving products and people locally, nationally, and globally. This is because those places that are the fastest, most agile locations to conduct business and whose firms are best connected to their customers, suppliers, and enterprise partners will capture disproportionate shares of capital investment. Those that fully leverage their international gateway airports to also attract large volumes of foreign tourists and upper-tier business services, such as Amsterdam, Dubai, Hong Kong, and Singapore, should do especially well.

With a rich history in mining, structural steel and other and heavy manufacturing industries, Ekurhuleni finds itself severely challenged by the winds of economic change. Mining is all but gone, with barely 1 percent of the municipality's employment currently in that sector and traditional manufacturing continues to decline. Social problems associated with high unemployment fester.

Despite these storm clouds, sun is appearing on the horizon. Newer, high-tech and other light-industry firms such as precision manufacturing are beginning to sprout in the EMM, logistics and distribution investment appears to

be on the upswing, more tourists are being attracted (especially Chinese and Indian) boosting retail and accommodation/ entertainment revenues, and white-collar business services are beginning to look at areas closer to ORTIA for office locations after a nearly 20-year exodus to Sandton.

As global and local structural shifts proceed apace, Ekurhuleni (and indeed the entire Gauteng Province) finds itself at an economic crossroads. Strategic decisions and development initiatives taken today will determine the future direction the Metropolitan Municipality and greater province go in terms of industrial mix, business competitiveness, job creation, and citizen prosperity.

Critical issues are at stake. Will Ekurhuleni and the Gauteng Province continue to transition successfully to "new economy" high-tech and information-intensive business services sectors? Will their traditional agricultural and manufacturing as well as emerging high-tech and white-collar producer service industries be able to compete effectively throughout Africa and worldwide in the decades ahead? Can the municipality and province capture a solid share of the 1 billion increase in foreign tourists anticipated over the next ten years? Will both fully capitalize on the forecasted growth of ORTIA and improve their multimodal surface transportation infrastructure to better leverage the airport and to attract more investment and create high quality jobs? Finally, will industrial and commercial development around ORTIA be economically efficient, attractive, and environmentally sustainable, presenting positive first

and last impressions to air travelers and becoming an enduring magnet for new economy workplaces and workers?

All these challenges, of course, are inextricably interwoven. How they are addressed will shape the economic future of Ekurhuleni and Gauteng Province. It is therefore imperative that they be addressed with both strategic vision and coordinated action. This requires, first, a solid understanding of the pivotal roles speed, agility, and connectivity play in 21st century business location, job creation, and economic development. Second, ACSA, ORTIA, EMM, Gauteng Province, and the Federal government must implement an integrated set of strategies, policies, and programs to harness and leverage these new competitive drivers for the municipality's, the province's, and the nation's industrial and commercial advantage.

Apropos the above, it is abundantly clear that a catalytic convergence of aviation, digitization, globalization, and time-based competition is changing the rules of industrial competition and business location. The interaction of these four factors is creating a new economic geography with major international airports driving and shaping business location and urban development in the 21st century as much as highways did the 20th century, railroads in the 19th, and rivers and seaports in the 18th. Today, these airports have become instrumental connectors for tourism, corporate and professional activities as well as key nodes for time-critical manufacturing and distribution. In the process, airports have

become powerful engines of economic development, attracting air commerce-linked businesses of all types to their environs and helping them grow.

As more and more aviation intensive businesses cluster near these airports and along transportation corridors radiating from them, a new urban economic form is emerging—the Aerotropolis—stretching upwards of 25 kilometers outward from larger airports. With the airport serving as a multimodal transportation and logistics nexus, strings and clusters of office complexes, research and technology parks, shopping facilities, medical and wellness cluster, industrial parks, distribution centers, entertainment and sports venues, and entertainment/tourist attractions are forming around the airports and along connecting surface transportation corridors. Even places located as far as 60 kilometers from some airports are experiencing accelerated economic growth, as will be documented later.

Because of this, there is little doubt that ORTIA will be counted on more than ever in the decades ahead to serve as a catalyst for Ekurhuleni's and Gauteng Province's business competitiveness and economic development. But to have such heightened economic impact, much greater cooperation will be required among key stakeholders, including ACSA, SAA, government agencies from local to federal levels, and the private sector, especially financial institutions and major commercial real estate developers.

Under the leadership of its Executive mayor, Clr Mondli Gungubele, the Ekurhuleni Metropolitan Municipality has placed high priority on better leveraging its unique asset, ORTIA, for business recruitment and Aerotropolis development. Gauteng Province leadership and high-ranking Federal officials have likewise recognized the value of better leveraging ORTIA and have made the Ekurhuleni Aerotropolis a top priority, as well. In fact, both are beginning to see the Ekurhuleni Aerotropolis it as providing a third powerful urban economic node in Gauteng Province, complementing and reinforcing Johannesburg and Tshwane. Thus, a primary objective of this strategic roadmap is to encourage the necessary Aerotropolis planning across all government levels and foster new public-private initiatives so that ORTIA can achieve its full potential as an engine for urban revitalization and economic development around the airport and throughout Ekurhuleni and the greater Gauteng Province.

With this objective in mind, the Ekurhuleni Metropolitan Municipality, commissioned me to provide the vision, strategic guidelines, and action-specific recommendations for ORTIA and its municipal environs to become the multimodal commercial core of a Ekurhuleni Aerotropolis. Pivotal to the vision, strategy and actions, is positioning ORTIA as a world-class air logistics hub that will drive airport-linked industrial and commercial development substantially beyond airport perimeters.

To set the context for this vision and strategy for a ORTIA Air Logistics Hub and Ekurhuleni Aerotropolis, the remainder of this chapter will (1) discuss the business rationale and competitive logic for this strategy so that ORTIA executives and municipal and provincial officials can confidently make the case to others, (2) provide concrete examples of air logistics hub/Aerotropolis successes elsewhere (and their key commercial components), and (3) discuss the credibility and viability of successfully transforming ORTIA and its nearby areas into a successful air logistics complex, airport city and greater aerotropolis that drives province-wide airport-linked commercial development.

Following this introductory chapter covering the above issues, three additional chapters offer, in order, the infrastructure, business plan, and implementation plan guidelines to assist those who will design, finance, develop, and manage the air logistics hub at ORTIA, its airport city, and surrounding aerotropolis to attract investment and generate the greatest local and province-wide economic impacts. Along with discussions of future infrastructure and commercial development of ORTIA and its surrounding areas, critical success factors will be presented, facility demand forecasting and risk analysis highlighted, as well as target industries specified.

To attract newer, high growth, high value-adding industries, I will stress the importance of logistical capabilities of ORTIA offering Ekurhuleni Aerotropolis and provincial firms quick and efficient access to their national and

global suppliers and customers, including the development of a value-adding logistics and industrial development zones at and around ORTIA. Aerotropolis principles and guidelines will also be presented to make ORTIA's cargo zones, airport city, and the Ekurhuleni Aerotropolis more economically efficient, attractive, and environmentally sustainable.

The report concludes with recommendations and action steps to be followed by stakeholders responsible for ORTIA and its outlying jurisdictions to successfully develop the air logistics hub, airport city, and broader Ekurhuleni Aerotropolis along with intermodal logistics villages throughout the province. Those recommendations and action steps focus on required hard and soft infrastructure as well as the business and aviation-sector recruitment strategies to be pursued to provide greater connectivity, speed, and agility to area firms: the three factors I'll continuously emphasize for gaining competitive advantage in the 21st century. The strategic roadmap and its recommendations will also address requirements for developing an Ekurhuleni Aerotropolis master plan, future facility demand forecasts and analysis, and public and private sector options for developing, operating, and managing logistics complexes while promoting and coordinating Ekurhuleni Aerotropolis development.

1.2 Competitive Logic and Business Realities Shaping Air Logistics and Aerotropolis Development

In my recent book (with Greg Lindsey), *Aerotropolis: The Way We'll Live Next*, I describe how aviation networks operate as the new physical Internet connecting supply chains and business people quickly and efficiently across distant markets. They also bring in tourists from distant locations. We are thus observing airport development, business development, and urban development progressing together around the world.

Driving much of this development process is the growing importance of fast-cycle logistics, especially that which utilizes air cargo. Indeed, the 21st century is becoming as much the "Fast Century" as the "Aviation Century." The two, in fact, go hand-in-hand, as customers from international markets are demanding speedy and reliable delivery of products, often with distinctive features. An industrial advantage is thus being gained by firms that respond flexibly and rapidly to their domestic and global customers, delivering lower cost, higher-quality (often customized) products quickly and efficiently.

In addition, high-tech manufacturers, such as the German firm in the scenario at the beginning of this chapter, must be able to access quickly global networks of suppliers of materials, components and sub-assemblies in order to obtain the best-quality components at the lowest possible price, and meet

emergency replacement needs. Likewise, contract drug and medical testing often requires 24-hour turnaround from source to test site and often back to source, the latter usually done electronically. The value of fresh fish, fresh produce, and fresh cut flowers is tied to speed of delivery from sea or farm to customers often thousands of miles away.

At the same time, increased flows of information worldwide are leading to rapid changes in customer demands. Companies that can detect these changes, design and produce the desired products, and deliver them more quickly than their competitors capture market share. Since speed also reduces warehousing and inventory costs, stock-outs and remaindered goods, the speed advantage becomes a cost advantage as well.

Fast-cycle logistics as a new competitive tool is being further validated by marketing research which shows that, worldwide, consumer tastes and product demands are changing much more swiftly today than was the case in prior decades. Indications are that such shifts will accelerate even faster in the decades ahead, resulting in situations where products that are "hot" one month may become obsolete just a few months later. Such is already happening in the fashion clothing industry and with digitized devices like iPhones where delivery time to the retail shelf (or now directly to the customer) frequently separates market winners from losers.

The implications of these trends for fast-cycle logistics strategies are already evident. Adapting to growing market demands for flexibility and speed, companies such as Apple, Benetton, Boeing, Dell, GlaxoSmithKline, Nokia, Siemens, and Walmart are re-engineering their sourcing and distribution systems to become much more agile and customer responsive. They now compete not only on price and quality but also on the basis of speedy, reliable delivery, and after-sales support (often including repair and return) of their products. They manage complex networks that encompass the entire value chain of suppliers, distributors, and customers across continents.

Mandating such changes are rapid and relentless worldwide technological, political, and economic transformations. Modern transportation, telecommunications, and goods-producing technologies have spread throughout the globe. Trade policies are being liberalized and new markets opened. Communist and former socialist countries such as China, Russia, Poland, and Vietnam have entered the capitalist marketplace with vigor. Huge wage differences between advanced industrial and developing countries have resulted in much wider geographic dispersion of component manufacturing sites, places of assembly, and of final sale. With rising workforce skills in developing nations and rapid cross-border technology transfer, countries such as Brazil, China, India, Malaysia, Poland and, of course, South Africa have achieved much greater levels of economic output and now produce highly sophisticated products.

International customers have also become far more sophisticated and demanding. They have available an unparalleled variety of products from all over the world. They are able to assess and identify value, and are therefore highly selective in purchasing. They expect quality, competitive pricing, and reliable delivery. They also want customization of the products they buy, and they want these customized products right away, not in two to six months. For many purchases, not even two to six weeks is fast enough.

1.3 E-Commerce and Order Fulfillment

The rise of e-commerce further heightened time-based competition and the importance of airports. As late as 1995, sales through the Internet were essentially zero. According to Forrester Research, 166 million packages were shipped in 1999 by Internet retailers (e-tailers), with approximately 70 percent going by expedited delivery. By 2003, e-tailers were shipping 1.1 billion packages annually. This grew to nearly 2 billion packages in 2006 and exceeded 3 billion in 2010.

These statistics reflect the growth on on-line sales. On-line retail sales in the U.S. alone, according to the U.S. Department of Commerce, exceeded $150 billion in 2010, excluding travel; travel adds approximately another $120 billion

more. By 2013, U.S. on-line sales of $229 billion are anticipated with an additional $158 billion in travel.

Worldwide, Goldman Sachs projects that e-commerce will grow from US$572 billion to US$963 billion between 2010 and 2013, a nearly 20% compound annual growth rate. That fastest growth is now anticipated in developing nations such as the BRICS. Many of the products where global sales are growing the most are typically shipped by air such as medical products, aerospace components, consumer electronics, and high-value perishables.

It is near consensus among economic and business forecasters that e-commerce will mushroom around the globe in the future. Most of this explosive growth is expected to be business-to-business (B2B), supply-chain transactions where materials and components will be ordered through the Internet and quickly shipped to next-stage producers. Manufacturers already are able to electronically access an international network of suppliers in order to acquire the best-quality materials and parts at the lowest possible price. The introduction of e- marketplaces (auctions, aggregators, bid systems, and exchanges) is greatly expanding B2B e-commerce: Forrester Research estimates that e-marketplaces currently account for up to two-thirds of B2B supply-chain transactions, depending on the industry, capturing 42 percent of on-line industrial trade and an average 28 percent of all business-to-business trade. Many suggest that with the wide-spread introduction of Enterprise Resource

Planning (ERP), these e-commerce figures will go much higher in the near future. According to the firm, e-marketer, B2B e-commerce which stood at $551 billion in 2003 reached $1.3 trillion in 2008 and now exceeds $1.6 trillion.

The expansion of the B2B e-commerce and direct-to-customer Internet orders has placed a particular premium on speed and reliability in the delivery process. To meet these new imperatives in order fulfillment, e-commerce distribution centers are being built near air cargo and air express hubs that have speedy, reliable global shipping networks. Air express hubs actually extend the business day for e-commerce and other forms fulfillment by allowing shippers drop off orders for expedited national or global delivery as late as 11:00PM. Dozens of such e-retailers have located their fulfillment centers near Memphis International Airport to leverage FedEx's world-wide air express services. The same trend holds for Louisville International Airport and Indianapolis, where numerous companies have also sited e-commerce and other fulfillment centers. This is likewise happening near major air cargo airports such as Hong Kong International, Paris–Charles de Gaulle, and Viracopos, Brazil. In Chapters 2 and 3 I will address building air cargo and air express capacity at and around ORTIA.

Complementing airport-linked fulfillment centers are flow-through facilities for perishables (either in the organic or economic sense), just-in-time supply-chain and emergency parts provision centers, and reverse logistics

facilities for the repair and upgrade of high-tech products such as notebook computers and mobile phones. The clustering of such time-critical goods facilities near air-express airports is stimulating further expansion of air cargo, less-than-load (LTL) trucking, freight forwarders, and third party logistics providers (3PLs) along major highways with quick accessibility to these airports.

Speedy, reliable delivery of products over long distances has become so critical to the new economy that air commerce is quickly becoming its logistical backbone. According to the International Air Cargo Association, approximately 36 percent of the value of world trade now goes by air, and the percentage is steadily rising. Air logistics, which includes air cargo, air express, and their supporting logistics services represented a $280 billion industry in 2011. It is expected to nearly triple by 2030, while international air-express shipments are expected to increase four-fold during this period.

Already, air cargo and air express are the preferred modes of international shipping of higher value to weight B2B transactions in microelectronics, medical instruments, mobile telephones, high-end fashion clothing, pharmaceuticals, optics and small precision manufacturing equipment, as well as many perishables such as seafood and fresh cut flowers. (See the global supply-chain model of iPhone 4 in Exhibit 1.1) Even lower value to weight B2B product distribution including apparel, shoes, and seasonal toys are becoming time-sensitive and increasingly shipped by air.

1.4 The Importance of Air Passenger Service

It's not just time-critical goods processing facilities that are clustering around hub airports. As the world's service economy also shifts into fast-forward, these airports are becoming magnets for regional corporate headquarters, trade representative offices, international banks, and professional associations that require executives and staff to undertake frequent long-distance travel. Airport access is likewise a powerful attraction to information-intensive sectors such as consulting, advertising, legal, medical, and specialized financial services, data processing, accounting and auditing, which often send out professionals to distant customers' sites or bring in their clients by air. This has been particularly the case at hub airports which offer greater choice of flights and destinations, more frequent service, and more flexibility in rescheduling.

With the shortest time between two distant locations being a non-stop flight, the accessibility commercial air passenger hubs offer has become essential to attracting business meetings and conventions, trade shows, exhibitions and merchandise marts. Such long-distance accessibility has made them attractive locations for large venue tourism and entertainment venues (such as casinos, theme parks, and even Formula 1 race tracks, etc.).

High-tech workers and airports also increasingly reinforce each other. With intellectual capital supplanting physical capital as the primary factor in 21st

century wealth creation, time has taken on heightened importance for today's knowledge workers as has the mobility of these workers over long distances. Research conducted at the University of California has shown that high-tech workers travel by air 400 percent more frequently than workers, in general, giving rise to the term "nerd birds" for aircraft connecting U.S. high-tech centers such as Austin, Boston, Raleigh-Durham and San Jose.

Some observers have suggested that advances in Internet access, videoconferencing, and other distributed communications technologies will diminish the need for air travel. The evidence indicates that telecommunications advances often promote additional air travel by substantially expanding long-distance business and social networking that lead to future face-to-face meetings. (See Business Week, August 20–27, 2007 cover story "The Future of Work" for illustration of this.) In point of fact, every significant advance in telecommunications technology has led to greater travel beginning with Alexander Graham Bell's first words over his newly minted telephone: "Watson, come here, I need you."

Others have suggested that prolonged global economic downturns exacerbated by periodic catastrophic events such as 9/11 and the constant threat of terrorism, along with contagious disease outbreaks such as swine flu (H1N1) will permanently diminish air commerce, in general, and passenger travel, in particular. This does not seem likely since the business imperatives giving rise to

the growth of air commerce and business travel (speed, mobility and global access) are increasing in importance. In both 2010 and 2011, air cargo and air passenger travel rebounded strongly from their 2008–2009 cyclical dips, as they have from their previous dips (see Exhibit 1.2).

There are also those that contend that rising jet fuel prices and aircraft contributions to greenhouse gases will limit future growth in commercial aviation and, indirectly, airport-linked development. This has not happened thus far and, in my opinion, is unlikely to slow forecasted aviation growth. Moreover, significant advances are in the works on more fuel efficient jet engines which reduce emissions while aircraft manufacturers, airlines, and airports have commence all-out efforts to reduce aviation's carbon footprint.

According to figures released by Boeing at the June 2011 Paris air show, the 4.9 billion passengers traveling annually world-wide in 2010 are forecasted to grow to over 13.3 billion by 2030, with air cargo projected to grow at even faster, more than tripling in this time period. With rising income levels around the world (especially in large emerging markets such as Brazil, China, India, and South Africa) leisure travel is expected to mushroom along with business travel. Thus, as noted previously, there is every reason to believe that the 21st century will indeed become known not just as the Fast Century but also as the Aviation Century.

1.5 Economic Impact and Job Creation at and Around Airports

The economic impact in terms of commercial real estate investment and job creation around many commercial airports has been immense. For example, the office market around Chicago's O'Hare International Airport is the second largest in the entire U.S. Midwest. Likewise, there is more class A office space around Washington, D.C. Dulles International Airport and along its connecting highway corridors than there is in the entire District of Colombia and the Dulles aerotropolis region has the second highest retail sales in the U.S., just behind Manhattan (New York City). Since 1970, nearly 1 million jobs have been created along and near the Dulles highway access corridor connecting the airport to Washington, D.C.

Atlanta Hartsfield-Jackson Airport's Aerotropolis generated an estimated 434,000 jobs in 2009 and contributed US$58.2 billion in direct and indirect revenues to the metropolitan economy. Memphis International Airport (world headquarters of FedEx) is responsible for over 160,000 jobs in the metropolitan area. One of four jobs in the region is tied to the airport, which has an annual economic impact in 2009 of $29 billion. Air cargo and air express operations account for 95 percent of the airport's economic impact and regional job generation. I will return to Memphis later in this chapter.

Ontario California International Airport, which is the U.S. west coast regional air express hub for UPS, with a strong FedEx presence as well, has been the engine of major growth in Southern California's Inland Empire. Since 1990, an average of over 10 million square feet of logistics and distribution space have been added annually around the airport and along nearby I-10 and I-15 Interstate Highways. Now class A office clusters, large retail, and tourist attractions are following.

In Penang, Malaysia air cargo has created a "Silicon Island" contributing immensely to job creation near the airport. Dell Inc. manufactures 100% of its laptops in Malaysia. The company relies heavily on air express in its Malaysian facility sourcing and exports, having over 2,000 employees alone there, with $5 billion in its sales originating from Penang. Its firm clustering impact has also been huge as 70 Dell suppliers have either manufacturing centers or distribution centers at Penang, providing parts and components.

Viracopos Airport in Campinas, Brazil, is a growing cargo airport with a substantial FedEx presence; 10 percent of all Brazilian air imports arrive though air cargo facilities there. Viracopos has greatly contributed to Campinas becoming the second fastest growing high tech area in all of Latin and South America, with investments in microelectronics and information and communications technology (ICT) totaling US$9 billion in the past 12 years. Fifty Fortune 500 companies have located high tech manufacturing facilities in

Campinas, including IBM, Motorola, Lucent/Alcatel, Samsung, and Texas Instruments making it the Silicon Valley of South America.

The impact of airport-induced job growth on land use in the vicinity of airports is likewise substantial. Recent research at UNC's Kenan Institute of employment growth in the suburban rings of U.S. metropolitan areas showed that areas within eight kilometers of airports are adding jobs much faster than the overall job-growth rate of the suburban ring within which the airport was located. While most of the employment is concentrated near the airport or along major connecting highways within 15 minutes of the airport, research at Massachusetts Institute of Technology's International Center for Air Transportation documents that impacts occur up to 75 kilometers from airports with air connections significantly facilitating a region's access to suppliers, markets, ideas and capital (EconSouth, 2003).

The next section will elaborate specific economic and job impacts focusing on key commercial features of air logistics hubs, airport cities and aerotropolises. These cases will be followed by a discussion of factors that influence their success or failure.

1.6 Features of Air Logistics Hubs, Airport Cities, and Aerotropolises Evolving in Europe, the U.S., Asia, and the Middle East

To gain a deeper understanding of the essential elements of airport cities and aerotropolises emerging around the world, I will highlight their existing and planned commercial components. These cases will provide a better understanding of the types of commercial development ORTIA and Ekurhuleni may expect to see (or plan to implement) in their air logistics, airport city and aerotropolis development. I begin with Europe, then move to the United States followed by Asian illustrations, concluding with the Middle East.

1.6.1 European Airport City and Aerotropolis Experiences

Europe has been a pioneer in the airport city model, with Amsterdam Schiphol first introducing this approach to airport and airport area development in the early 1990s. Others such as Paris have followed and are beginning to expand their airport cities into full-fledged aerotropolises. Here I describe Paris Charles de Gaulle, Amsterdam Schiphol and Frankfurt as exemplary models for the ORTIA, Ekurhuleni and Gauteng to consider. Frankfurt is particularly appropriate because land and environmental constraints forced it to develop three commercial complexes with approximately the same amount of space that

ORTIA has available for its airport city. I also include Helsinki-Vantaa Airport for an excellent public-private partnership model of aerotropolis planning and development—Aviapolis.

1.6.2 Paris Charles de Gaulle

In the past three years, Paris has made an explicit and organized commitment to implementing the Aerotropolis model at and around its primary hub airport: Charles de Gaulle (CDG). Two cooperating organizations are leading this effort. The first is Aerotropolis Europe led by integrated air express company FedEx and consisting of 12 major companies located either on the airport or near it. This organization was formed in 2008 to promote logistics and commercial development in the immediate airport area following aerotropolis land-use principles.

The second organization is Hubstart Paris made up of 20 public and private organizations with the aim to strengthen the international visibility and attractiveness of the greater Roissy area (with CDG at its center) focusing primarily on 10,000 hectares surrounding the airport covering six municipal jurisdictions. In January 2011, the two aerotropolis organizations signed a cooperative agreement to collaborate on developing and enhancing the CDG

aerotropolis area from an economic, infrastructure, and sustainability standpoint.

The Aerotropolis engine, CDG, handled 58.2 million passengers in 2010 making it the second busiest airport in Europe in terms of passengers. It is the busiest in terms of cargo, processing 2.4 million tonnes in 2010. As the European hubs for FedEx and the Air France/KLM Alliance, CDG serves 400 destinations domestically and around the world. With two sets of parallel runways, the airport has a current annual capacity of 72 million passengers and 3 million tonnes of cargo, both of which can be expanded as demand warrants.

The airport itself has 6,686 ha of land of which 1,310 ha are dedicated to real estate, including it four major terminals and cargo facilities. CDG is operated aeronautically and developed commercially by Aeroports de Paris (ADP) which is a stock-listed company of which the French State is a majority shareholder. The operator has a separate real estate division focusing on airport commercial growth.

For nearly two decades ADP has been developing CDG into an airport city. The airport currently hosts 700 firms employing 86,000 workers. Its airport city's central business district is Roissypole located between its two sets of parallel runways and near its four major passenger terminals (see Exhibit 1.3). Roissyville has 216,000 m^2 of offices, of which 125,000 m^2 are operated by ADP, and the remainder by the private sector, or in a joint venture with them. At

present, more than 100,000 m^2 of additional office space is planned. The business district also has three hotels of 68,000 m^2 (including the recently expanded 772-room IBIS hotel) with three more planned, the first of which is scheduled to open in late 2014.

Roissypole Airport City is directly served by regional light train service and an automated people mover which connects it to the passenger terminals. These all come together at International Terminal 2 which also provides a platform for the high speed (TGV) train which has a primary stop at CDG. Over 60 cities in France and Belgium are served by this high speed train which draws some 5 percent of CDG's passengers.

Above International Terminal 2 (and its rail platforms) is the Sheraton Paris Hotel and Conference Center (see Exhibit 1.4). This business class hotel has 240 rooms and 12 suits along with 22 high-tech meeting spaces which can host business meetings of up to 100 executives and professionals.

Along with the five current hotels on airport property offering 1,954 rooms, there are 23 additional hotels in the immediate airport area providing 4,373 rooms (including a hotel cluster of 3,000 rooms that is only a six-minute drive to passenger terminals) and 12 other hotels in nearby communities. Over one-third of CDG area hotels are legitimate 4-star quality.

Under construction just west of the airport fence is Aeroville, a 110,000 m^2 shopping mall with 625,000 m^2 leasable space. Sited on 12 hectares, ADP

provided the land valued at €10.5 million in a joint venture with Unibail-Rodamco which is investing €270 million. The mall, which is targeted to the 86,000 employees at CDG and residents of nearby communities, is scheduled to open at the end of 2013.

A number of other major projects linked to the airport are in the development process. One is the multimodal Euro CAREX project on 350 ha adjacent to the airport, near the FedEx hub (see Exhibit 1.5). Served by high speed rail, this development will offer fast freight service to cities ranging from 300 to 500 km from CDG. It is forecasted to transport 600–700 tonnes of cargo annually including 900 air freight pallets per day to cities such as London in a little over two hours and to Amsterdam in three hours, at a considerably lower cost than by air and with lower CO_2 emissions. FedEx and the French postal service are founding sponsors of this multimodal platform which will be opened in three phases from 2015 and 2020.

Another aerotropolis mega-project underway close to the airport is International Trade Center (ITC). Scheduled to open in early 2014 at a cost of €600 million, ITC is within walking distance of the airport's perimeter hotel cluster. The project covers 321,573 m^2, including nearly 49,000 m^2 of exhibition space, 35,000 m^2 of conference facilities, 25,000 m^2 of offices and shops together with 3,340 parking spaces. This complex will also house six hotels (110,000 m^2) offering 1,600 rooms including a 5-star Grand Hotel and Spa with 312 guest

rooms. It is forecasted that the International Trade Center will have 2,500 employees and attract 1.2 million visitors annually.

Two other major projects worth noting in the airport area include the Sud CDG project and International Business Park. Sud CDG (South CDG) is planned on 200 ha for 850,000 m^2 of head office functions geared to international trade, high value-added logistics, and to businesses related to innovation and the knowledge economy. International Business Park will be a complementary multi-functional office complex being developed on 150 ha north of the airport aimed at high technology companies in various sectors. Together, these two developments are expected to add between 15,000 and 20,000 jobs to the CDG Aerotropolis.

A number of smaller developments are in the planning stages in the 10,000 ha CDG Aerotropolis zone. Even more are in the planning and development stages along or close to the 20 km highway corridor (A1) connecting CDG to central Paris (see Exhibit 1.6). Like the Johannesburg–ORTIA highway corridor, this corridor is experiencing dual commercial development (1) from the city outward as Paris office growth is increasingly land constrained and (2) toward Paris from the airport as businesses seek accessibility both to CDG and the city.

1.6.3 Amsterdam Schiphol

Amsterdam Schiphol is the leading European airport city and is clearly driving a greater Aerotropolis. Its grounds employ 62,000 people daily—far more than the 50,000 resident criteria to attain metropolitan central city status in the U.S. Two major expressways link the airport to downtown Amsterdam and the broader urban area. A modern train station, directly under the air terminal, efficiently connects travelers to the city center and the rest of the Netherlands though its local and intercity rail lines.

Schiphol's passenger terminal, incorporating modern retail plaza design elements, contains expansive, well-appointed shopping and entertainment arcades accessible both to travelers and the general public (see Exhibit 1.7). By combining terminal design with mall design, Schiphol has substantially increased revenues through concession rents and passenger purchases. In fact, the airport often attracts Amsterdam residents who come to shop and relax in its public section and plaza, especially on Sundays when most city retail stores are closed. To enhance the passenger experience, Schiphol's terminal even has a branch of the Rijksmuseum where passengers can view famous Dutch Masters' paintings, as well as a casino.

A 100,000 sq. ft. multimedia aviation theme park (National Aviation Theme Park Aviodrome) has been developed at the Aviodrome in nearby

Lelystad. Partnering and co-branding with KLM and Boeing, the Aviodrome highlights 100 years of aviation progress, providing an additional leisure experience for Schiphol's air travelers and visitors.

Directly across from Schiphol's passenger terminal is the 4 million sq. ft. World Trade Center with meeting and commercial facilities and regional headquarters of such firms as Thomson-CFS and Unilever. A Sheraton and a Hilton hotel, both recently upgraded to 4- and 5-star status, adjoin this complex, as do a series of office buildings including the European headquarters of Microsoft (Exhibit 1.8). Surrounding Schiphol (near the airport fence) are large tracts of land being developed for office, leisure, light industrial, and logistics purposes (see Exhibit 1.9). These include Schiphol South-East and Schiphol Logistics Park for cargo distribution and 3PLs; Anthony Fokker Business Park and Schiphol Eizenhof with 2.9 million sq. ft. and 2.2 million sq. ft. of offices, respectively; Schiphol-Rijk for time-sensitive light industrial and the Schiphol Golf and Business Center for sports, golf and leisure activities that are to complement a corporate office campus on the site.

Providing excellent regional highway access, the A4 and A9 high-speed motorways are both within a mile and a half of the airport center. Radiating from Schiphol along these motorways are strings and clusters of business parks, logistics parks, high-tech industrial parks, distribution centers, information and telecommunication complexes, and wholesale merchandise marts such as the

famous Aalsmeer Flower Auction Market—all of which are airport-intensive users. Exhibit 1.10 illustrates the synergies between Schiphol's Airport City and its broader regional Aerotropolis.

An excellent example of airport-Aerotropolis development synergy is Amsterdam Zuidas within a southern reaches of the city of Amsterdam, about six minutes by airport expressway or airport express train to Schiphol's passenger terminal. Zuidas is a 21st century airport "edge city" containing over 11 million sq. ft. of class A office space and retail, along with a large mixed-use commuter rail terminal with a World Trade Center above it. Among its occupants are the world headquarters of ABN AMRO and ING banks, plus numerous regional corporate headquarters of other multinational firms who rely on Schiphol airports excellent European and international connectivity for business purposes (see Exhibit 1.11).

In good measure because of the airport and its multimodal commercial mix, over 1,000 international companies have chosen the Amsterdam region as a place to invest and create jobs, many of which located in downtown Amsterdam, not just Zuidas.

Schiphol's experience illustrates that as the aerotropolis forms and evolves, can be a reinforcer of downtown investment and business vitality, rather than a competitor. We have seen this in Asia (Hong Kong, Seoul, Singapore, etc.), the U.S. (Atlanta, Chicago, Miami, etc.) and throughout Europe.

As will be stressed later, airport cities and aerotropolises typically reinforce and strengthen central city commercial development rather than compete with it.

As one concrete U.S. example, Boeing located its world corporate headquarters in downtown Chicago, rather than the O'Hare airport area, even though most of its commercial activities it deals with, including the headquarters of United Airlines, are in the immediate airport area.

In fact, in some nations, the airport area (if properly developed and maintained) has become so attractive to office and time-sensitive industries that it often commands the highest commercial rents in the metropolitan region. This can be seen in Exhibits 1.12 and 1.13 which present the office rents (Eu/m2/yr) and industrial rents for 2010 in the immediate Schiphol area compared to those of Amsterdam city center and other outlying locations. Research on industrial rents around the globe show that the highest are found adjacent to London's Heathrow airport. And one of the classiest and most business friendly hotels in the world is the Sofitel Grand Luxe connected directly to Heathrow's new T-5 which commands up to €3,000 per night for its suites. Less than a 90 meter walk from the baggage claim area of T-5 and the Heathrow Express rail line, this airport hotel offers 45 meeting rooms and a 1,700 delegate conference center, making it the third largest conference venue in the UK.

1.6.4 Frankfurt International Airport

Fraport, as it is known from the name of its management company, is the most international hub in the world with 119 different scheduled airlines flying to 304 destinations in 106 countries. Every single day the airport handles over 145,000 passengers (54% of whom are transfers), 10,000 meters and greeters, 6,000 metric tonnes of cargo, 1,300 aircraft and 380 terminal-linked passenger trains (both short and long-distance).

Its international hub status brings in tens of millions foreign passengers annually who eat, shop, and otherwise participate in Fraport's terminal street-scapes of commercial establishments. These include 17 duty-free shops, 88 specialty retail stores, 58 food and beverage establishments, and 53 service establishments including a medical clinic serving 36,000 patients annually and a casino. Together, these terminal retail and services facilities brought Fraport well over US$200 million in revenue in 2010.

Because Fraport is surrounded by protected green areas on the one side and noise-sensitive communities on the other, it has been constrained in its outward growth. Fraport management has therefore had to be innovative in its approach to airport city development. It has therefore followed a strategy of commercial development based on the principles of best use and highest value, maintaining top international standards. Airport management has also

coordinated closely with officials of surrounding municipalities to prevent misunderstandings.

Connected by pedestrian walkways to Terminals 1 and 2, respectively, are Frankfurt Airport Center 1 and 2. These 1 million+ sq. ft. complexes contain offices, banks, a 1,008-room Sheraton convention hotel with a 1,400-person congress center and an executive tower with all business services. The two airport centers' office complexes are targeted to companies engaged in aviation and tourist-related businesses as well as for business meetings and trade shows.

Rail is less than a five minute walk from the public section of the airport's terminals and to the local and regional commuter rail station under Terminal 2 as well as to the long-distance ICE train station with 174 daily connections throughout Germany and Western Europe.

The Squaire, formally know as Airrail Center, opened in 2011 above the airport's long-distance (ICT) train station. This nine story mega-complex, which is more than 300 meters long, also has superb highway access and is just a six minute walk from Fraport's international gates via a covered pedestrian walkway (see Exhibit 1.14). It comprises 1.6 million sq. ft. of class A office space, high-end retail, restaurants of all types, a wellness center, and two Hilton hotels (one of which is 5-star quality with conference facilities). Its primary tenant at present is the European headquarters of KPMG, which is leasing 40,000 square meters. Numerous other companies, small and large, are leasing space at the

"The Squaire" which brands itself as "New Work City" (a take-off on New York City) since it offers most of the services found in a major city under one roof, at the airport.

Nor far from The Squaire is a development just getting underway called Gateway Gardens (see Exhibit 1.15). This 3.8 million sq. ft. project is being position as a management hub and civic plaza for international business. Designed with cutting-edge architectural style Gateway Gardens will offer trend-setting corporate office buildings, hotels, restaurants and entertainment facilities with "new urbanism" civic plazas and a central park (see Exhibits 1.16 and 1.17). In addition to business offices and their supporting urban services, an International Trade Center with meeting and conference facilities is planned. Development, which is being financed through a public-private partnership including Fraport, is expected to be market-driven and incremental, commencing this year through projected build out in 2016.

The third major development, near the other end of the airport, is a 272 acre mixed-use project called the Mönchhof site. This site will be adapted to a range of commercial facilities from logistics companies to large-scale retailers to airport-related enterprises and is being led by the real estate division of Fraport. Like Gateway Gardens, quality construction, aesthetics, and a sense of community will be emphasized at the Mönchhof site.

1.6.5 Helsinki's Aviapolis

Aviapolis, covering 42 square kilometers (4,200 hectares) around Helsinki-Vantaa Airport (12.8 million PAX, 154,000 tonnes of cargo in 2010), is among earliest and most ambitious efforts in Europe to develop an aerotropolis. It's origins were in the mid-1990s when a unique public-private partnership (PPP) was formed among airport area land owners, real estate developers, the City of Vantaa and Finavia (the state-owned operator of HEL) to drive economic growth in the airport region. In my opinion, Aviapolis represents the best public-private organized and implemented aerotropolis in Europe.

To accomplish its economic and real estate development objectives, the PPP planned and created an integrated logistics, industrial, commercial and residential platform which leverages HEL's aviation network and improved both local and long-distance surface connectivity to attract investment and create jobs over Aviapolis' 42 square kilometers. And it succeeded. By 2010 Aviapolis had become the number one business investment site in Finland with 36,000 jobs located there, many in the high-tech and information-processing service sectors (see Exhibit 1.18). Major companies such as Audi, Philips Electronics, Polar Electronics, Suunto, and Volkswagen have located their corporate offices in Aviapolis, some with innovative retail outlet facilities adjacent to them. A key attraction for these head offices is said to be Aviapolis' well-planned commercial

and residential zones together with lifestyle amenities the development team implemented targeted to those working, living in, or visiting Aviapolis.

Along with developing attractive housing projects, all community and consumer services were incorporated into or near them including international schools, daycare centers, libraries, parks, and the largest shopping mall in northern Europe. Next to this jumbo mall, entertainment facilities were built including the 87,000 m^2 Flamingo Entertainment Complex which contains a hotel, spa, nightclub, movie theaters, restaurants, wellness center, indoor water park, and bowling ally. In addition to serving 20,000 nearby residents, the combined jumbo mall and Flamingo complex has become a retail/entertainment destination for the Helsinki region.

Aviapolis also has other clusters of hotels (as well as the recently expanded and upgraded Hilton Hotel at the airport). In 2010, the Rantasipi Congress Center was opened to accommodate conventions, meetings, incentives, and exhibitions and a 24,000 m^2 World Trade Center has been developed by Finavia's subsidiary, LAK Airport Real Estate, Plc (see Exhibit 1.19). Nearby is the 31,000 m^2 Airport Business Park and the 21,500 m^2 Avia Forum housing the recent arrival of electronic giant, Philips. Avia Tower, a 21-story 20,000 m^2 high-rise office tower contains a number of knowledge-based companies while the 23,000 m^2 Econia development is the first office building in Finland to be powered by solar energy, highlighting Aviapolis' sustainability theme.

Office and commercial facilities are being constructed mostly by a consortium of Finish real estate companies, including Sponda, Plc; SRV Vitoset, Ltd; Restel Oy, Ltd; and Finavia's subsidiary, LAK Airport Real Estate, Plc. The City of Vantaa also participates in Aviapolis real estate investment.

Two business support platforms are geared to fostering innovation and attracting high-tech firms to Aviapolis and the greater airport region. The City of Vantaa has developed and largely funds the the Vantaa Innovation Institute with 300 companies participating in such fields as RFID (radio frequency identification) and clean environmental technology. The Institutes's latest project, in partnership with GreeNet Finland, has created a platform called Airport Cluster Finland. The objective of this platform is to promote know-how of Finnish companies in airport technology solutions. A similar platform in the Ekurhuleni Aerotropolis could generate long-term public, environmental, and financial returns to ORTIA.

The second catalytic platform for Aviapolis is Technopolis, a large office building complex that houses and provides technology and knowledge-intensive firms with all the facilities and services they need to operate successfully. Technopolis is a stock exchange listed company which has a number of locations in Europe including the large one in Aviapolis shown in Exhibit 1.20. In fact, it is Europe's largest technology business support center, serving 930 companies and 12,000 professionals who work in Technopolis facilities. According to its website

(http://www.technopolis.fi/) these tenant companies range from small start-ups to mid-size and large tech companies, as well as firms engaged in international business and trade.

There are a number of other Aviapolis projects in the planning and development stages. One of the most interesting and substantial is the Aviation Station District being developed by its landowner LAK-Airport Real Estate, Plc. Working with the City of Vantaa and the urban design team of helsinkizürich architects, LAK has completed all planning. It is moving forward with this mixed-use commercial, residential, and business district above the major airport rail station that is scheduled for opening in 2014 as a key node in the new Helsinki Ring Rail Line. Conceived as the multimodal urban heart of Aviapolis, this large multi-functional platform consists of three main components: (1) multimodal transportation services including a metro bus station adjacent to the underground train station, (2) a mixture of living and working facilities, and (3) leisure and tourism services (see Exhibit 1.21). LAK is in charge of the overall project and coordinating with private-sector partners who will do the actual development of the commercial and residential components.

Apropos the above, the Aviapolis development consortium is acutely aware of the importance of connecting multimodal surface transportation infrastructure to effectively leverage HEL airport and its surrounding aerotropolis to attract business investment. It has, therefore, worked very closely

with the Finnish federal government to put highway, rail and port connections in place to make Aviapolis more accessible and appealing for logistics functions and commercial real estate development. The consortium worked to improve the E18 highway which connects Aviapolis to other Scandinavian countries and to St. Petersburg, Russia, as well as implement high-speed rail connections to St. Petersburg, now just three hours away by train. The PPP also convinced the central government to improve access of Aviapolis to Helsinki's new port in Vuossari when it moved from downtown Helsinki in 2008. It was also instrumental in collaborating with the Finnish government in creating the new Ring Rail Line that not only improves connectivity of HEL to downtown Helsinki, but also makes Aviapolis more accessible to a range of outer Helsinki's residential, logistics, industrial, and commercial nodes (see Exhibit 1.22).

In sum, there are a number of good lessons to be learned by both ACSA and Ekurhuleni from Aviapolis in the planning and development of the ORTIA Airport City and Ekurhuleni Aerotropolis. Perhaps the most important of these are the power and effectiveness of public-private partnerships and having the active support of the nation's central government for infrastructure provision and business recruitment. Close to this in value was having Finavia, the partnering City of Vantaa, the land owners, and major real estate developers all understand the mutual benefits of the aerotropolis model and their willingness to work collectively on its Aviapolis design and construction.

1.7 U.S. Airport City and Aerotropolis Cases

Let us now take a look at what is going on in the United States. I choose four cases which highlight airport property and greater aerotropolis development: Dallas-Ft. Worth, Memphis, Detroit, and Kansas City.

1.7.1 Dallas-Fort Worth

DFW is the cornerstone of Dallas-Ft. Worth Metroplex, the fastest growing region in the U.S. between 2000 and 2010 (see Exhibit 1.23). Its regional economic impact was estimated to be $19 billion in 2006, though I understand a recent update soon to be released increases that economic impact considerably.

The airport property itself is enormous—18,000 acres, covering parts of 4 cities and two counties, actually exceeding the size of New York City's Manhattan Island. Airport officials plan to take advantage of the airport's vast size by developing nearly 6,000 acres for commercial use over the next 20 years.

Airport property development is targeted to six key areas as shown in Exhibit 1.24. Two are for planned air cargo expansion (East Air Cargo, which has hundreds of developable acres, and West Air Cargo which anchors most current cargo facilities). DFW management is pressing hard for additional wide-body passenger and cargo flights to Asia (especially China). They have also formed

partnerships with commercial real estate firms such a Trammell Crow and air cargo oriented investors such as AMB to construct “high velocity flow-thru” cargo facilities in the west cargo area. Such large commercial real estate companies not only have expertise in state-of-the-art cargo facility development, but they also bring with them a rich network of potential cargo and other logistics tenants.

International Commerce Park (see Exhibit 1.25) is targeted to light industrial, freeway commercial, and flex office development. It currently has 264 acres leased with 115 remaining for industrial/commercial development.

A retail/hospitality/entertainment complex is planned on the northwest corner of the airport. Covering nearly 200 acres it will contain mixed use retail, restaurants, garden offices, a hotel and entertainment facilities (see Exhibit 1.26).

Bear Creek Office Park is an 1,800 acre tract with open space amenities being marketed primarily as a corporate campus site (see Exhibit 1.27). Because of natural streams and floodplain in this park, substantial open space must be maintained. The land-use plan thus calls for two 18 hole championship golf courses along with wildflower meadows and heavy tree cover. It is felt that this environment will be optimal for office development just minutes from the airport terminals, with open-space amenities desired by today's knowledge workers. A smaller amount of shielded light industrial and mixed use development may also be in this large tract's future.

Southgate Plaza is a 45-acre hybrid development at the southeastern end of the airport (see Exhibit 1.28). An innovative public-private partnership was formalized in April 2009 between the airport authority and the private-sector real estate developer which will serve as the master developer of Southgate Plaza, a 1.5 million square feet mixed use airport property project. Utilizing a ground lease, the developer is providing all of the internal infrastructure (roads and utilities). In turn, all ground rents go back to the develop until the infrastructure costs are paid back. This saves the airport upfront infrastructure costs. Moreover, operating as a private-sector firm, the developer can move mush faster since it does not have to meet traditional government bureaucratic regulations in awarding construction contracts.

Designed to be DFW's southern gateway, Southgate Plaza is proposed to accommodate two hotels, office complexes, and restaurant and retail space. Connected to terminals via shuttle bus service the project will create 2,700 permanent jobs, US$95 million in wages and salaries and an initial $3.2 million in rent annually for the airport. As noted, this rent will be rebated to the developer until infrastructure development costs are paid back.

In addition to those planned at Southgate Plaza, hotels have become pivotal to DFW's airport city environment. These include the large existing Hyatt Regency DFW and Grand Hyatt attached directly to its international passenger terminal.

DFW's Grand Hyatt featuring meeting rooms and concierge business support services represents how airport hotels are increasingly acting as virtual headquarters for new economy firms and are shaping a new corporate meeting style. The following paragraph extracted from the August 20–27, 2007 issue of Business Week magazine on the future of work, illustrates:

> The fact that virtual connections still need to be balanced with face-to-face contact places the airport squarely in the path of modern urbanism. Consider the experience of Sage Software Inc., a $1 billion company which sells software to help businesses run better. It has 30 locations throughout the U.S., the result of a nine-year acquisition spree, but no headquarters. So its eight-member executive team, scattered from Tampa, Fla., to Irvine, Calif., fly once a month to Dallas. There they check into the Grand Hyatt DFW in terminal D for two days of meetings. Everyone can get there for a 1 p.m. start, work until 6 p.m., get dinner together, and then work all day the next day until 5 p.m., when they run for the next flight home.

Commercial activity and resulting non-aeronautical revenues have become critical for DFW to meet its infrastructure and facility expansion and modernization needs. It has also helped the airport be more competitive and connected by keeping airline costs down. In 2010, 65 percent of DFW's revenue came from commercial activities.

While DFW is evolving as a new urban core of Metroplex, its economic reach and impact extends many miles out along nearby interstate highways and expressways. Two excellent examples of this are Infomart and Dallas Market Center, both of which are located on the I-35 corridor to DFW. Infomart is a

huge, ultra-contemporary merchandise mart for information and communication technology (ICT) companies. Tens of thousands of visitors travel through DFW annually to attend Infomart trade shows.

Dallas Market Center—a cluster of four large buildings that contain nearly five million square feet of display space for fashion clothing and home merchandise—is the world's largest wholesale merchandise mart. Hundreds of thousands of buyers and vendors fly into Dallas annually to conduct business at Infomart and Market Center. In 2010, Dallas Market Center alone attracted buyers and vendors from all 50 U.S. states and 84 countries, who purchased 300,000 airline seats and filled 720,000 nearby hotel rooms while conducting an estimated $8 billion in wholesale transactions.

The airport has been a major factor in attracting nearly 20 Fortune 500 corporate headquarters to the broader airport region including five major Fortune 500 headquarters to Las Colinas just east of DFW. This 12,000 acre airport-linked community has 22.3 million sq. ft. of class A office space, 8.5 million sq. ft. of light industry, 1.3 million sq. ft. of retail, over 14,000 single- and multi-family residences, 2,845 luxury and business-class hotel rooms, 75+ restaurants, and 4 championship golf courses. Dedicated light rail to DFW and to downtown Dallas is being developed.

Future regional passenger rail to DFW will be an important and integrating feature of the broader airport region with longer-term sustainability

implications to reduce airport area congestion. Exhibit 1.29 illustrates planned routes of future light rail, commuter rail and high-speed rail lines that will feed into DFW's terminal stations.

As is common in Texas, nothing is planned and developed in a small way. What impresses me, though, is the recognition by airport management and airport-area planners of the growing importance of aesthetics and environmental amenities as they develop properties.

1.7.2 Memphis

In less than 30 years, FedEx has transformed Memphis from a sleepy mid-size southern city into a global trading center. Its Memphis hub is the largest, most connected air logistics complex in the world. In 2010, the airport handled 4.1 million metric tons of cargo, 96% due to FedEx which processes over 3.3 million packages per day on average.

Burlington North Sante Fe Railroad (BNSF) has opened a new $200 million Memphis intermodal facility in early 2010. The expansion increases the size of the facility to 185 acres and provides the potential for 1 million lifts a year. As of January 2011, Delta/Northwest Airlines offered 279 daily scheduled departures to 89 U.S. cities and to Amsterdam.

As a result of the FedEx presence, the economic impact of Memphis International Airport is immense. According to a 2009 study by the University of Memphis, the airport had a $29 billion impact on the metropolitan economy in 2008, $27.1 billion resulting from air cargo activities. A total of 220,154 jobs in the metro area are tied to the airport (32,000 employed by FedEx alone) which constitutes over 1 in 4 jobs in the Region. Almost half of the businesses in the Memphis area feel that their economic future is linked to the airport.

Because of the high employment multiplier effects of air express and air cargo activities (e.g., trucking, logistics, and distribution centers, time-sensitive assembly, repair and testing, etc.). Memphis International Airport has an economic impact greatly disproportionate to its passenger numbers and population base (see Exhibit 1.30 for comparable 2004 figures). For example, while Phoenix Sky Harbor Airport has nearly four times the annual passengers and its metropolitan population base is three times larger than Memphis, Memphis International has an economic impact that is 50 percent larger than Phoenix Sky Harbor airport.

A substantial aerotropolis is evolving at and around Memphis International Airport. In addition to logistics and distribution facilities, hotels, office parks, retail and entertainment complexes are locating along airport corridors. The FedEx hub has attracted major arterial clusters and strings of logistics and distribution facilities (see Exhibits 1.31 and 1.32). These include:

- World's largest laptop computer repair depot—Flextronics repairs 3,000 laptops each day with same-day turnaround
- World's largest cornea bank—The National Eye Bank Center
- World's largest DVD distribution center—Thomson Technicolor ships 1.2 million DVDs per day (½ of DVDs purchased in the U.S.)
- Largest overnight drug testing center in the U.S.—Advanced Toxicology runs up to 10,000 lab tests per night for next day delivery

Major national distribution facilities for Hewlett-Packard, Sharp, Cingular, Jabil Global, Pfizer, Baxter, GlaxoSmithKline, Medtronic, and many others have located in Memphis largely because of the FedEx hub. Some of these, such as Sears logistics services, Hewlett-Packard, Nike, Williams-Sonoma and Thomson Technicolor, operate distribution facilities that exceed two million square feet.

To foster between growth around the airport and throughout the broader region, which composes the Memphis Aerotropolis, two organizations have been formed. One is a Memphis Airport Area Development Corporation, which is focusing on aesthetic improvements and investment in the immediate airport area. Operating with private-sector funding from a number of Memphis' leading corporations (e.g., FedEx, Medtronics, Elvis Presley Enterprises), the corporation has a full-time executive director and substantial operating budget. Its primary objective is upgrading the appearance of immediate airport area and drawing more attractive businesses to corridors leading into and out of the airport to

create more positive impressions by business people and tourists coming to Memphis.

The second is a Memphis Aerotropolis Steering Committee composed of public and private sector leaders in the region. Four task groups have been created: (1) airport corridor planning and development, including high priority commercial clusters, (2) gateways and beautification to create short-term visual improvements in the immediate gateway area in collaboration with the Airport Area Development Corporation, (3) access and transportation to support passenger and freight movements and reduce congestion, and (4) marketing an branding including website development, promotional advertising in the media, and developing the brand of Memphis as "America's Aerotropolis"

In 2008, the Memphis Region Chamber of Commerce hired a full-time vice president for Aerotropolis and Logistics Development. This executive plays a key role in coordinating and supporting aerotropolis initiatives by various public and private-sector groups across the Memphis region.

1.7.3 Detroit

Detroit officials are acutely aware that they are spiraling down economically and that bold steps must be taken to overcome the likely continuing decline in its automotive manufacturing sector and other traditional

industries. In a regional assessment of its assets to compete in the new economy, one clearly stood out—the region's aviation connectivity through Detroit Metro Airport (DTW).

DTW (a Delta Airlines hub) is the sixth busiest airport in the U.S. in terms of takeoffs and landings serving 160 non-stop destinations in the U.S., Europe, Asia, and Latin America. Seven miles from DTW is Willow Run Airport (Detroit's original municipal airport) that has become a significant air cargo airport that is home to numerous charter cargo airlines, including the nation's leading on-demand heavy-lift cargo carrier.

Just to the south of DTW's runways and near the intersection of two major U.S. interstate highways (I-94 and I-275), is an 1,800-acre (800 hectares) open land parcel known as The Pinnacle. Further assessment showed that there was actually over 23,000 additional acres of developable sites in the aerotropolis area (see Exhibit 1.33). A public-private leadership group was formed (now called the Detroit Region Aerotropolis Steering Committee, similar to Memphis' Aerotropolis Leadership Committee) to encourage zoning and development plans to leverage the two airports to attract new industry to the broader airport area and serve as a nucleus of renewed regional economic development and business competitiveness.

In 2006, nine governments near Detroit Metropolitan Wayne County Airport and Willow Run Airport signed a memorandum of understanding to co-

operate in moving aerotropolis planning and development forward. The following year, a 35-member public-private leadership task force was established to oversee the formation of an aerotropolis plan.

A Detroit Region Aerotropolis land-use plan, completed in 2008 by Jones Lang LaSalle, identifies 13 primary development sites for airport-linked commercial development covering approximately 5,000 acres of land with potential expansion to 25,000 acres. The plan estimates that upwards of 60,000 jobs can be created.

An Aerotropolis Development Corporation (ADC) has been formed which will provide for a unified, cross-jurisdictional mechanism for moving the Detroit Region Aerotropolis forward. The ADC collaborates with local governments (two counties and seven municipalities) on four primary activities (1) marketing and business attraction, (2) master planning and design standards, (3) regulatory assistance and incentives, and (4) inter-governmental communication and coalition building, including outreach to businesses, citizens, and landowners.

It promotes long-term partnerships among communities, build relationships with existing businesses in the region, co-operate with other economic development entities in the region, and has worked with the State of Michigan and U.S. federal government to provide infrastructure and financial

incentives to attract air commerce related businesses to the Detroit Region Aerotropolis. All of this will boost airport passenger and cargo volumes.

The ADC is being funded through membership fees by local government signatories (who compose the Corporate Board) and private-sector contributions. Reporting to the ADC Corporate Board is a 10-12 member executive committee of public and private sector participants, providing continuous oversight of the Development Corporations activities.

Over the past eight years I have given a number of presentations to this group on the aerotropolis concept. From these presentations, the steering committee put together Exhibit 1.34 which illustrates how my generic model might be adopted to specific commercial and residential land uses, including the creation of a ring road with two aerotropolis corridors (I-94 and Ecourse Road).

One of the issues that concerned the Aerotropolis leadership group was how to overcome the image of Detroit as an unattractive, old industry "Rust Belt" region. Most commercial development around DTW neither effectively leveraged the connectivity the airport offered, nor was it physically attractive—much of it being clusters of less expensive hotels and strips of conventional small stores and service establishments (convenience, gas stations, auto body shops), with some older factories and warehouses along the connecting highways.

When 1,300 acres of the Pinnacle property just south of DTW were acquired by the airport authority and Wayne County for noise mitigation for the

fifth runway, plans were drawn up to use this as a new image-building gateway to DTW to signal Detroit's emergence into the new 21st century economy. Over 1,000 acres were designated as Pinnacle Aeropark, with a planned physical layout, green space, and commercial facilities providing a much more appealing and contemporary "front door" to the Detroit region by air travelers (see Exhibit 1.35)

The project was designed with the physical features, site amenities, and support services to attract and support clusters of research and high tech firms, Class A office buildings, value-adding logistics and transformation centers as well as exhibition, education, and meeting facilities in an aesthetically pleasing and functionally integrated fashion. Amenities and support services proposed include, among others, luxury hotels, conference facilities, fitness centers, a championship golf course, jogging and biking trails, upscale shopping, restaurants, and a high-speed telecommunications infrastructure.

Wayne County, the initiator of the project, is envisioning the Pinnacle as a "business location with wings" fully leveraging the project's adjacency to Detroit Metro Airport to provide tenants and users with excellent national and global air access. Their assumption is that time-pressed executives and professionals whose responsibilities require frequent travel to branch facility, partner, or client sites will have access in minutes to DTW's passenger terminals for day and possibly even half-day business trips. Firms who frequently bring in their clients by air

for meetings, presentations or direct service can host them with one day round trips, avoiding the costs of overnight stays. Those clients or colleagues needing to remain for longer periods will have available, convenient on-site amenities such as first-class hotel accommodations, golf, fitness centers, and quality restaurants and shopping. These amenities would also be available to international or other long-distance travelers connecting through DTW and as an attractive "airport city" destination for local residents.

To attract high-tech goods-processing firms, supply-chain management and value-adding logistics service providers will be targeted. As the FedEx hub at Memphis has demonstrated, in many new-economy industries, hours and even minutes are of critical importance to meeting market objectives. Examples here include medical and pharmaceutical laboratory testing facilities, organ banks, and lost credit card reproduction, all of which depend on rapid national and global shipping turn-around.

To appeal to today's knowledge-workers and new economy industries, the Pinnacle model was planned to blend efficient business form and function with on-site amenities. Carefully planned and aesthetically integrated clusters of flex-tech, research and development, clean light manufacturing, and value-adding logistics/transformation (as opposed to big-box warehouse and distribution) facilities will radiate from the core. These facilities, which will be developed following covenants, restrictions, and quality construction design

standards, will have contemporary, architecturally appealing facades with buildings interspersed with biking and pedestrian trails. The Pinnacle's planned distinctive roundabout serving as the town center, landscaped green space, and campus-like clusters of commercial facilities will be highly visible to millions of U.S. and international passengers flying into and out of Metro each year, acting as a reinforcing 21st century visual complement to the new $1.2 billion McNamara terminal that most will pass through (see Exhibit 1.36).

Numerous studies have documented that knowledge-workers and their high tech firms frequently seek architecturally distinctive, planned campus-like settings that are relatively self-contained and provide green space and opportunities for active recreation. Incorporating such land use, the Pinnacle hopes to set the standard for Detroit Region Aerotropolis development and go a long way toward transforming the commercial use of the airport area. Its planned site design, architectural features, and anticipated commercial tenants would no doubt markedly improve the appearance of the airport area while helping change Detroit's image from a region of traditional manufacturing to a location for high tech firms.

In terms of commercial use, initial Pinnacle planning shows approximately 25 million square feet (576 acres) devoted to "flex tech" buildings that will enable customized allocation and periodic reallocation of administration, research, laboratory testing, engineering, production, and

materials processing either under one roof or in one concentrated area. Approximately 4.7 million square feet (109 acres) are allocated for value adding logistics/transformation facilities that conduct supply chain management, kitting, sequencing, reconfiguration as well as information technology functions for tracing and tracking goods flows around the world. There are also 3.6 million square feet (83 acres) allocated for commercial development, and 2.9 million square feet for Class A offices. The remaining acres are designated for landscaped open space, recreation, and rights-of-way (see Exhibit 1.37).

At full development, phased over an estimated 15-year time-frame, the Pinnacle has been targeted to generate approximately 25,000 full-time jobs, including 13,000 in office, research, and technology, 7,500 in logistics, and 4,300 in retail/commercial. It is anticipated that this project will evolve into the central business district (or airport city) of the broader Detroit Region Aerotropolis.

Development of the Pinnacle has been slowed by the U.S. commercial real estate crisis and other factors to the disappointment of many in the Detroit region. Yet, attracted by easy air transport and availability of land, a number of businesses have decided to locate in the aerotropolis, creating numerous jobs. For example, in 2009 General Electric located its clean energy and wind power R & D facility near the airport bringing 1200 jobs to the area. General Motors and A123 Systems, a battery maker, located new facilities employing nearly 4,000 people. And Chinese auto parts suppliers are locating in the Aerotropolis.

A major long-term benefit has been the public-private partnership formed which generated the State legislation to provide special tax benefits to firms locating in the Detroit Aerotropolis. Another huge long-term benefit is that the PPP is working closely with the U.S. Congress to pass the Aerotropolis Act of 2011 which will provide resources for surface infrastructure improvements in Aerotropolis areas in the U.S.

1.7.4 Kansas City

Kansas City International Airport (KCI) encompasses 10,200 acres in a low density suburban setting, 20 miles northwest of downtown Kansas City. KCI offers flights to 68 non-stop destinations in the U.S., Canada, and Mexico.

In 2010, the airport had just over 11 million passengers and handled about 114,000 metric tons of cargo; small by major city airport standards. It offers just 48 non-stop flight destinations in the U.S., Canada, and Mexico. A 2006 study showed that KCI's economic impact on the area totaled $5.5 billion and generated almost 61,000 jobs.

For the three decades since KCI opened it has been counted upon to attract business and drive economic development in the northern part of the metropolitan area. Yet, in the eyes of many, results have been disappointing. Airport-linked commercial development has been slow to evolve. Most of the

10,000 acres that fall within KCI's boundaries remains vacant despite the fact that nearly the entire airport has been designated as a Foreign Trade Zone. Moreover, even with its excellent highway connectivity, only a handful of distinct KCI-linked business clusters can be identified in its outlying reaches.

Initial planning for a KCI aerotropolis three years ago included combining existing commercial development just east of the airport with proposed new development that will constitute the KCI Business District, or core Airport City (see Exhibit 1.38).

With the KCI Business District (Airport City) established, clusters of hotel, retail, office, industrial logistics, and residential units are anticipated to develop outward from the airport along nearby interstates and state highways.

According to Kansas City area officials, there are approximately 10,400 acres of industrial/office park development (off-airport) in the airport area recommended land use plan. Development proposals are in place on 3,200 acres and these plans provide: 14.5 million square feet of office, 17.8 million square feet of logistics/industrial and 2.6 million square feet of retail.

Hotel clusters and mixed-use residential are also planned. Combined commercial and industrial development is expected to employ 90,000 workers. Exhibit 1.39 illustrates the type of Aerotropolis development which would be expected to occur near KCI over the next five to ten years.

A major inside-the-fence business park, known as KCI Intermodal BusinessCentre, has also been planned and is going to be developed by Trammell Crow on 800 acres in the southeastern sector of the airport (see Exhibit 1.40). It is designed to simultaneously leverage the aviation and air cargo infrastructure of KCI along with its nearby highway systems to provide time-sensitive manufacturers, distributors, and logistics service providers with efficient sourcing, production, and distribution. Initial industry targets are high tech (especially semiconductors), aerospace components, cargo distribution and third-party logistics providers.

The site is divided into four development areas. The first two (the airfreight and hanger areas) were directly tied to the primary airport functions. As such, they are purposely isolated from other uses to provide a greater measure of security. The other two areas provide for a more standard office distribution and industrial development. The site area, building area and building type are illustrated and detailed in Exhibit 1.41 and the table below.

Development type	Site area	Building area	Building type
Airfreight	300 acres	2,240,000 sq. ft.	2 story
Maintenance/Hangar	65 acres	462,000 sq. ft.	1 story
Office/Distribution/Industrial	207 acres	1,763,300 sq. ft.	1 story
Office	69 acres	1,254,500 sq. ft.	2 & 3 story

Groundbreaking occurred in late 2008 with Phase I completed a year later. At present, master developer the Trammell Crow Company is still recruiting

target firms. In July 2011, Trammell Crow and KCI airport announced the intermodal business center's first tenant Blount International, a global manufacturer of replacement part for various types of equipment. The facility will occupy 10 hectares and serve as the company's North American distribution center.

While optimism remains with airport management and local officials, the thirty-year history of limited Kansas City airport area development shows that aerotropolis formation does not always occur rapidly at and around airports, even if sufficient open land exists. In particular, aviation connectivity to national and international markets must reach a critical mass, which KCI lacks, for substantial airport-driven development to occur and be sustained. This has proven to be the shortcoming in numerous other locations in the U.S., especially cargo-oriented airports such as North Carolina's Global TransPark and the Southern California Logistics Airport in Victorville, California, about 130 kilometers northeast of Los Angeles.

1.8 Asia's Airport Cities and Aerotropolises

Asia is leading the way in airport city and aerotropolis development. One key reason is that their airports are newer with many constructed on greenfield sites. This enables officials to design and develop them and their surrounding areas

consistent with the new roles of airports in the local and global economy. Many Asian airports also can be planned by powerful government bodies that simultaneously control the development process of the airport and its environs with few social or environmental constraints. Below, I elaborate three leading examples: Hong Kong, South Korea's Incheon, and Singapore.

1.8.1 Hong Kong International Airport

Hong Kong International Airport (HKIA) is an exemplary airport city and aerotropolis in evolution. Its 1,258 hectare (2,700 acre) site was created in the mid-1990s by leveling two small islands and reclaiming land from the sea.

The airport opened in July 1998 with a total project cost of US$20 billion, including a 26 miles multi-lane expressway and modern airport express train to both Kowloon and Hong Kong Island.

Three commercial districts adjacent to or near HKIA's terminal and runways are well along in development (see Exhibit 1.42). The 70 acre South Commercial District is composed of logistics facilities, including (1) Tradeport Hong Kong Ltd., constructed and operated by an international consortium of Asia and European Partners, (2) HACTL's Super Terminal 1 (the world's largest stand-alone air-cargo and air-express facility with a gross area of 2.7 million sq. ft), (3) the 2 million sq. ft. Asia Air Freight Terminal, and (4) a 1.4 million sq. ft.

mixed-use freight-forwarding warehousing and office complex. DHL has opened its Asia air express hub in this zone, as well, with Cathay City (a major aviation-linked office complex) developing nearby, (see Exhibit 1.43 showing Cathay City under construction next to the HACTL super cargo terminal and Tung Chung New Town in the background).

The 52 acre East Commercial District is being developed as an office park. It will have gross floor area of 3 million sq. ft. targeted to regional corporate offices and air travel-intensive professionals. The 125 acre North Commercial District is the Airport City's signature development zone, known as SkyCity. The 10 million sq. ft. commercial development is adjacent to the passenger terminal and served by the airport express train. SkyCity's master planner, Skidmore, Owings & Merrill, designed it as a commercial destination for working, shopping, meeting and trading (see Exhibit 1.44).

SkyCity's first phase opened in late 2006 and contains SkyPlaza, a multipurpose commercial complex connected to the passenger terminal and the airport express train station. The lower floors of SkyPlaza provide a 300,000 sq. ft. retail center, including an 4D Extreme Screen theater (see Exhibit 1.45). Above this podium is class A office space with a total gross floor area of another 300,000 square feet.

SkyCity's first phase development also includes a 750,000 sq. ft. international exhibition center (Asia World Expo) with full-time trade

representative offices, SkyPier (a China cross-boundary ferry terminal), a 650-room hotel, and the SkyCity Nine Eagles (9-hole) golf course (see Exhibit 1.46). The future phases will consist of a business park, hotels, and leisure and entertainment facilities developed in a pedestrian friendly and public-transit integrated way (see Exhibits 1.47 and 1.48). The 1,171-room Regal Airport Hotel, which connects Terminals 1 and 2 opened in 2007. HKIA's passenger terminals house 30 high-end clothing designer shops along with over 100 other retail, food and beverage, and service outlets.

SkyCity will be the multimodal Central Business District of a far reaching Hong Kong Aerotropolis. In addition to its Hong Kong Island and Kowloon connections, it will be linked by the express train and highway to the nearby Disney Theme Park that also opened on the airport's island in 2006, about 10 minutes from the SkyCity (see Exhibit 1.49). The airport express train connects as well within 5 minutes to Tung Chung, a massive new town housing 45,000 airport workers and their families, complete with schools, churches, shopping and medical facilities (shown in Exhibit 1.43).

1.8.2 Incheon: Korea's Air City

Perhaps the most ambitious effort to develop on airport an airport city and greater Aerotropolis is taking place at and around South Korea's new Incheon

International Airport. At its core is Air City, a set of airport commercial complexes being developed with all the features of a modern metropolitan center: retail areas, office buildings, logistics and high-tech manufacturing facilities, ICT functions and leisure activities, a conference and exhibition center, as well as a mixed-use new town. Elaborate expressways, bridges and tunnels connect the airport to Seoul (42 miles to the North) and to nearby islands, the latter forming an expansive commercial and residential complex. A commuter rail line between downtown Seoul and Incheon International Airport was completed in 2010.

The airport property (15,000 acres) is considerably larger than most in Asia. Opened in March 2001, Incheon was immediately among Asia's major airports in passengers and cargo. Its current master plan (with a 15-year horizon) has commercial and residential development evolving through three phases, creating an ever broadening and deepening urban expanse (see Exhibit 1.51). The first phase (already complete) is an Airport Support Community consisting of airport-related industries (primarily logistics), commercial services, and housing for airport area employees and their families, which total 100,000. The second phase (also completed) involves expanding (both spatially and functionally) the Airport Support Community while transforming it into an International Business City. A 360 acre international business center composed of four office complexes,

a shopping mall, convention and exhibition facility and two five-star hotels opened between 2007 and 2009.

An additional 220 acre commercial project under development is the Airport Free Zone. This international logistics and manufacturing zone became fully operational in 2011. Both the International Business Center and Airport Free Zone are planned to double in space in the coming five years.

The third and most ambitious stage (The International Free Trade City) is a full-blown aerotropolis tied together by the extended Incheon free enterprise zone (IFEZ). The IFEZ will encompass three islands, connected by expressway bridges (man-made Songdo and Cheongra, along with Yeongjong where the airport is located). A pivotal component in the Republic of Korea's plan to transform the country into the commercial and trading center of Northeast Asia, IFEZ is being promoted as "Pentaport"—a combined airport, business port, seaport, teleport, and leisure port.

The greater Incheon Aerotropolis has dual urban growth poles. The first, Yeongjong Island, is its Air City, with development on the airport focusing on aviation-oriented office functions, hotel, trade and exhibition facilities, logistics, and tourism and leisure activities (see original conceptual plan Exhibit 1.52). Two of the largest are a 97,000m^2 water park opened in 2010 and a 164,000m^2 mixed-use commercial complex (IBC-I 1st phase) immediately south of Incheon's passenger terminal made up of two 4-star hotels with 850 rooms, four office

buildings with 2,500 business suites, a commercial building and golf course. The second phase of IBC has just started which will include 673,000m^2 of hotels, office buildings, a global medical center, retail facilities and a possible exhibition/ meeting complex. (see Exhibit 1.53). In December 2011 an M.O.U was signed between IIAC and an American developer to build a major portion of the IBC-II located to the northwest of the passenger terminal into an entertainment and leisure complex targeted to Chinese tourists.

Songdo Island will host the aerotropolis' second urban growth pole, New Songdo City, being created from scratch entirely on reclaimed land by Gale International of New York City and POSCO E & C (a division of South Korea's largest steel producer) in partnership with the Korean Government with financing through Morgan Stanley, the World Bank, ABN Amro and Kookmin Bank.

This 1,500-acre, US$33 billion project is the largest private development project currently underway in the world. At full build-out in 2015, New Songdo City will have over 15 million square feet of office and commercial space, more than 9,000 residences (mostly condominium and town houses), a convention center, a cultural center, a central park greenway, an 18-hole golf course designed by Jack Nicklaus, a state-of-the-art medical facility, and an international school for children of expatriate workers being planned by Harvard (see Exhibit 1.54).

Phase I of this mega-project which commenced in 2005 and was completed in 2010 includes a 1 million sq. ft. retail complex, a 1,000 room hotel, a 65-story trade center, and 2,360 homes. As an incentive to its developers, the Korean government has agreed to construct a six-mile, six-lane bridge from New Songdo City directly to Incheon International Airport and provide all utilities.

From the start of Air City on airport property to the development of New Songdo City six miles away, the Korean government is actively soliciting private-sector participation and foreign investment. Tax holidays and other generous financial incentives along with the provision of extensive infrastructure throughout the greater Incheon airport region are likely to catalyze considerably more private-sector development throughout this emerging Korean Aerotropolis.

1.8.3 Singapore Changi International Airport

Since commencing operation in 1981, Singapore Changi, 20 kilometers from downtown Singapore, has been considered among the most efficient and aesthetically pleasing airports in the world. The opening of its swank Terminal 2 in 1991 positioned Changi as an Asian leader in infusing passenger facilities with modern retail and service functions. The Civil Aviation Authority of Singapore (CAAS) has invested continuously to upgrade its two terminals and establish

them as commercial and leisure nodes of a relatively compact Changi Airport City. A third even more magnificent terminal, costing $1.8 billion opened in 2008, with an extensive array of commercial, cultural, and leisure services.

Branding Singapore and providing a memorable experience to airport users are key objectives to the ongoing modernization of the passenger terminals. More than 200 retail outlets, many with Singapore or S.E. Asia themes, line Changi's concourses in a free-flow manner. Artwork and waterfalls exhibit a sense of local history and natural beauty. Coffee shops and food outlets also provide a local flavor, modeled after the facades of 1960s Chinatown, while restaurants have open kitchens where passengers can observe cooks preparing Singaporean dishes along with a variety of other international cuisines.

At the same time, Changi's passenger terminals are state-of-the-art technologically and in service amenities. They were among the world's first to offer Wi-Fi access to passengers with laptops and high-quality surround sound lounge seats with plasma and liquid crystal video equipment. Small group movie theaters, sports and news viewing lounges, in-transit passenger sleeping, massage and shower facilities, along with health and fitness clubs round-out terminal commercial amenities. Passengers with a 5-hour layover can even take a 2 ½-hour off-airport tour, including the downtown financial district and a bum boat ride on the Singapore River. More than 60 percent of the airport's revenues come from non-aeronautical activities.

The limited amount of land surrounding Changi's 3,200 acre airport property has constrained landside commercial development. Connectivity to downtown Singapore has therefore been enhanced by a newly opened subway line that transfers travelers to the airport in about 20 minutes and a beautified tropical expressway with excellent taxi service between the airport and the downtown. The airport, airport expressway, and downtown are pristine, giving visiting business people and tourists a highly favorable impression of the Singapore city-state, a factor often noted in attracting international corporations. To spice up its sometimes staid image, large casinos with associated hotels and entertainment clusters are being constructed on reclaimed land near the expressway and close to downtown.

As one of Asia's leading tradeports, logistics is big business in Singapore, accounting for 8 percent of the nation's GDP. In 2001, CAAS along with Singapore's Economic Development Board and the local government authority created a 60 acre Free Trade Zone at the airport. Known as Airport Logistics Park of Singapore (ALPS), the zone has been developed to house value-adding third-party logistics providers, firms involved in assembling high-tech products, and e-commerce fulfillment. With direct airfield access, a considerable number of the world's top logistics firms already have located in the zone, most in multi-story facilities, given the airport's limited developable land.

The airport is minutes away from large wafer fabrication and disk-drive manufacturing facilities that rely on Changi's sophisticated and rapid international air cargo handling. Reclaimed open land lies to the east of the airport and to the west is an industrial park with an aeronautical focus. The Singapore Aviation Academy immediately adjacent to airport property provides state-of-the-art training facilities for those in the aviation industry.

Aggressive wide-lane highway development ensures that all of Singapore's industrial, office, hotel and exhibition space is in quick and easy access to the airport. The most distant industrial estate, for example, is still within 40 minutes of Changi. Because of the great importance of international air passengers and air cargo for Singapore's economy, Changi has become the pivotal transportation node in what is essentially an island-wide aerotropolis.

1.8.4 Taiwan Taoyuan International Airport

Taiwan opened a trendsetting gateway airport in 1979, shortly thereafter named Chiang Kai-Shek International Airport (CKS) in honor of its former military and political leader. Airport and government officials from throughout Asia visited CKS during the 1980s to see and learn from this modern aerodrome which quickly became one of the busiest in Asia (see Exhibits 1.55 and 1.56).

The airport was renamed Taiwan Taoyuan International Airport (TTIA) in 2006, reflecting its location in Taoyuan County, 40 kilometers southwest of downtown Taipei. By this time, challenges and some disappointments with TTIA had already emerged.

Despite two excellent hub airlines (China Airlines and Eva Airways), periodic infrastructure upgrades, and a second more contemporary passenger terminal added, the airport did not keep pace during the past 15 years with many of its Asian competitors. TTIA was thus leapfrogged in passenger volume and quality rankings by numerous newer, larger, more architecturally glamorous and commercially endowed airports in the region. Capacity constraints were also impacting terminal and airside operations.

Taking stock of TTIA's current shortcomings and future needs, The Ministry of Transportation and Communications (MOTC) has commenced a bold initiative to revitalize TTIA to regain its regional prominence, while making the airport a greater catalyst for Taiwan's business competitiveness and economic development. Designated the Taoyuan Aerotropolis project, the plan calls for significantly expanding and modernizing the airport's aeronautical and commercial infrastructure along with creating over 4,000 hectares of aviation-integrated business zones around it.

The aerotropolis plan was approved in 2009 by Taiwan's Executive Yuan (Cabinet) and has become the flagship project of the government. Nearly US$10

billion will be allocated to improving TTIA's infrastructure and facilities as well as its external transportation links. Much more will be spent by government and the private sector for infrastructure, commercial, and industrial development in TTIA's outlying aerotropolis zones.

Taiwan's MOTC uses the image of a fried egg when explaining how aerotropolis land use will evolve, and be administered. The expanded airport is likened to the egg yolk. This inner core, to be managed by a newly established airport company, will consist of aeronautical infrastructure and commercial facilities directly related to the airport such as terminal-based retail, offices, hotels, air cargo and logistics services.

The outer ring (or egg white), which is being planned by Taoyuan County, will house commerce and industry whose activities depend heavily on the airport. These would include facilities such as trade and exhibition complexes, time-critical light manufacturing, and medical tourism.

TTIA currently occupies 1,249 hectares, including a connected 45 hectare free trade zone (FTZ) operated via a concession with the Farglory Group. Plans are to expand the airport to the north by 575 hectares and to the east by 170 hectares, the latter adding 130 hectares to the airport's free trade zone. The Farglory FTZ is directly connected to TTIA and offers the full range of value-adding logistics functions such as kitting, testing, labeling, and even light assembly (see Exhibit 1.57).

Expansion will bring TTIA's total size to just under 2,000 hectares. The extended northern zone will house a future third 4,000 meter runway as well as additional air cargo operating areas and overnight aircraft parking slots necessary to meet demand of 58 million annual passengers and 4.5 million metric tons of cargo forecasted for 2030 (up from 21.6 million PAX and 1.4 million tons of cargo in 2009).

To serve anticipated growth in international passengers, much of this from increased cross-Straits travel between Taiwan and mainland China, a third terminal will be constructed. Depending on final decisions regarding the future use of original Terminal 1, Terminal 3 will be planned to process between 30 and 40 million passengers annually.

A design contract for this state-of-the-art new terminal was signed in late 2011, with construction targeted to commence by late 2014. This is the same year that Taiwan Taoyuan International Airport Access MRT System will connect TTIA to downtown Taipei (in approximately 30 minutes) and other key regional nodes. The MRT will serve all three terminal locations at TTIA as well as Taiwan's High-Speed Rail system about 7 kilometers away.

A major commercial complex will take shape adjacent to Terminal 3 which will house business centers, shopping, restaurants, leisure activities, and display space. A four or five-star hotel offering the full complement of concierge business and meeting services is also contemplated for the complex.

China Airlines recently opened its gleaming corporate headquarters at TTIA's entrance with a swank 360 room Novotel Hotel adjoining it. Two additional modern structures (a center for crew activities and a flight simulation training center) complete this new US$141 million complex.

Given Taiwan's leading position in microelectronics and information and communications technology (ICT) exports, air cargo and logistics are major components of TTIA, and will be even more so in the future. In addition to planned cargo facilities expansions by China Airlines and Eva Airways, Farglory Holdings has already invested over US$150 million in completing Phase I of its free trade zone logistics complex. The complex, operating under a 50 year BOT (build, operate, transfer) concession, includes the world's largest single-story automated air cargo terminal, a value-added logistics park (two buildings) and international distribution express warehouse and support facilities. Phase II, scheduled for completion by the end of this decade will include additional value-adding logistics facilities, a forwarder's building and a major business center.

TTIA plans to expropriate land for an expanded FTZ area adjacent to the Farglory FTZ. The area will house firms in time-critical distribution, merchandise testing and certification, vendor managed inventories, business process outsourcing (such as printing and distributing credit card replacements and payment request forms), e-commerce fulfillment, and value-adding logistics services like kitting or labeling for reexport.

To date, TTIA has been managed by a bureaucratic agency run largely by civil servants who lack autonomy, speed and agility in making strategic decisions. This bureaucratic structure was replaced in late 2010 by a more business-like organization called the Taoyuan International Airport Corporation (TIAC), Ltd.

Though remaining a subsidiary of the Taiwan government, the new airport corporation will be freed from much of the government red tape hindering efficient response to airport opportunities and challenges. It will therefore be able to negotiate and execute contracts with concessionaires, consulting firms, and construction companies in a quicker, more agile manner. It will also be able to hire and promote talented individuals based on performance. In short, the new airport company is set up to do business the way business does business.

It is anticipated that TIAC will eventually be listed on the Taiwan stock exchange enabling private-sector investment and returns which should further encourage improved airport performance. Privatization (partial or full) could also provide additional airport revenues for future facility modernization and infrastructure expansion.

The new airport company is expected to coordinate closely with those involved in broader aerotropolis development. This will promote stronger synergies between inside-the-fence and outside-the-fence developments.

The Taoyuan Aerotropolis consists of TTIA as its multimodal core and approximately 4,150 surrounding hectares divided into seven functional zones (see Exhibit 1.58). In laying out the seven outside the fence areas, Taoyuan County planners focused on highest and best land use leveraging proximity to the airport as well as transportation connectivity to the airport and the broader region.

To the immediate south of the airport are two aviation-related industrial zones. A 670 hectare aviation industry area will be geared to aerospace equipment design and manufacturing, aviation equipment repair, and air logistics services, plus a possible aviation training center. The 1,345 hectare airport-related industry zone (which also has a portion northwest of TTIA) is designated for aviation R&D, in-flight service industries, air sports and leisure industry, and car rental and parking, among other services related to the airport.

The 490 hectare Trade and Exhibition Area already with some development hosts an international convention center with future hotels, shopping, entertainment, and office buildings planned. This zone is further leveraged by a High Speed Rail station and MRT station, the latter which will connect to the airport.

A Refined (specialized) Agriculture Development Area of 460 hectares on the airport's southwest periphery is planned as an agriculture produce

distribution center. Auction centers as well as an agri-business technology R&D centers are similarly proposed for this area.

North of TTIA, a 360 hectare Coastal Recreation Zone is planned for marinas, water sports facilities, fish markets and indoor and outdoor water parks. Incentives will be provided to encourage investment in these as well as associated hotels with conference facilities, vacation homes, restaurants and shopping streets.

To the east, a 155 hectare Free Trade Related Zone will be developed to leverage the Farglory FTZ and the extended airport FTZ. Included in this zone will be automated warehouse and distribution centers, trade centers, and time-critical light manufacturing.

To provide good residences and minimize commute times, a number of quality living areas totally nearly 700 hectares are planned for various sections of the Aerotropolis. These will be designed as sustainable living communities based on balancing life, neighborhood, work and ecology. Aerotropolis quality living areas will also have mixed-use services such as shopping malls, restaurants, libraries and schools.

At present, the outside the fence aerotropolis zones are primarily conceptual and will be developed as economic demand and market opportunities emerge. For example, in the Airport-Related Industrial Zone planned to the northwest of the airport, it is possible that some portions outside

the airport's noise contours could support a significant "Health Port" made up of clinics to serve medical tourism along with health and wellness centers.

Success of an aerotropolis rests as much on surface transportation connectivity as it does on air connectivity. The MOTC, together with Taoyuan County transportation planners, have therefore been diligent in specifying highway and light rail improvements to TTIA and throughout the region. These include highway upgrades connecting the airport to Taipei and other major regional commercial nodes, as well as a series of airport area circular roads efficiently connecting all aerotropolis functional zones.

Such fast and efficient airport access to the broader northern Taiwan region will bring important commercial centers from metro Taipei to the north to the Hsinchu Industrial Park (Taiwan's Silicon Valley) to the south within the aerotropolis orbit, making a much more geographically expansive airport-integrated economic region. The goal of the government is for this expanded aerotropolis to be Taiwan's primary infrastructure asset to compete in the globally-connected, speed-driven economy of the 21st century.

1.9 The Middle East—Dubai: United Arab Emirates

The leaders of Dubai have been visionary in their use of air commerce to foster investment and development in this emirate. Recognizing that the emirate's

position halfway between Asia and Europe could make it an important transit point for passenger and cargo traffic, a decision was made in the mid-1980s to fully liberalize its air cargo and passenger access for development purposes.

This put air cargo at Dubai International Airport on a rapid trajectory. By 1998, the airport was handling 300,000 tons annually in its Cargo Village, with another 120,000 tons flowing through temporary areas. Dubai's air cargo has continued its rapid trajectory in recent years to 1.8 million tonnes in 2008, up from 940,000 tons in 2003. With cargo growth at the airport continuing at a breakneck pace (1.82 million metric tons in 2008), new facilities have followed suit. The first phase of a Mega Cargo Terminal with annual capacity in 2018 expected to be 3 million tonnes has been completed along with a state-of-the-art fresh flower facility.

Dubai's airport is within a free trade zone, which makes it even more attractive to companies looking to invest in the emirate. The Dubai Airport Free Zone (DAFZ) has 1.2 million square meters of space for offices, warehouses and distribution centers and manufacturing plants. Its benefits, including 100 percent foreign ownership of companies in the Zone, tax-free status for up to 30 years and no personal income tax, are designed to attract those companies producing high value-to-weight goods and shipping them by air. There are over 1500 companies in the DAFZ, including Bang & Olufsen, Boeing, Chanel, Diageo, Johnson & Johnson, LVMH, Mitsubishi, Caterpillar, Porsche, Rolls Royce and

Wyeth Pharmaceuticals. As of October 2008, approximately 80 percent of companies in the DAFZ were in the information technology industry.

So successful has development been at and around Dubai International Airport, that the emirate's leaders are currently constructing a second massive airport complex 10 years earlier than planned. The new Al Maktoum International Airport (JXB), which opened 2011, will be an example of the Airport City/Aerotropolis model. It will include planned clusters of industries in logistics, high technology, financial services and tourism whose needs are served by aviation. The entire Aerotropolis complex, when fully built out, will cover 140 square kilometers (54 square miles), including an airport operating area composed of five parallel runways and three passengers terminals with extensive shopping and entertainment arcades. The first commercial zone is Dubai Logistics City, located adjacent to the airport operating area and next to the Jebel Ali Free Zone.

Along with Dubai Logistics City, other aerotropolis components planned include (1) Commercial City which will Dubai World Central's business and financial hub with 85 towers ranging from six to seventy-five stories in height and expected to employ around 130,000 people, along with up to twenty-five hotels, ranging from three-star to five-star deluxe, (3) Residential City to house up to 250,000 people in a mix of two-story villas and luxury apartments in blocks reaching up to twenty-four stories in height. Residential City will also include

three hotels, an international school, medical facilities, and a large shopping mall.

Exhibit 1.59 is a rendering of Al Maktoum International Airport and its adjacent airport cities. Originally scheduled build-out is 2017; exceptionally fast by world standards, construction has been all but brought to a halt in 2009 as a result of the global recession and Dubai's commercial real estate crisis. Dubai's leaders claim strong commitment to completing this project as originally planned and see this as a three to four year delay until Dubai's commercial real estate market recovers. Others are not so optimistic and see delays stretching Dubai World Central's development over a much longer period than originally envisioned and substantially scaled down from that original vision.

In the meantime, other Middle Eastern countries have commenced airport city and aerotropolis development backed by immense energy resources. These include Abu Dhabi, Qatar, and Saudi Arabia. With World bank funding, Cairo has also commend planning for an Aerotropolis at and around its international airport, through progress has been slowed by turmoil there. To date, little more than conceptual plans are available, but the ones I have seen are highly ambitious.

1.10 Reasons for Successes and Failures of Air Logistics Hubs and Aerotropolises

Since the aerotropolis model is fairly new and the number of places that have specifically planned aerotropolises small, it is difficult and perhaps too early to assess success or failure. Efforts at creating air logistics hubs have a longer track record and their successes and failures along with reasons are clearer. I will thus start with them.

Asia, the Middle East, the U.S., and Europe have an over twenty-five-year record in establishing logistics air cargo hubs. The most successful large ones, such as Hong Kong, Incheon, Dubai, Memphis, Amsterdam, Frankfurt and Paris have done so based on a combination of location in rapidly growing cargo markets and a major hub airline generating the cargo. Those such as Paris Charles de Gaulle which have done well complement their extensive passenger hub connectivity with a regional air express hub such as FedEx. All others have substantial air express service which is the fastest growing international air cargo sector as well as general air cargo airline service. For this reason, I will give special attention in Chapter 3 (Business Plan Guidelines) on what is needed for ORTIA to attract more air express and general air cargo carriers.

Like air cargo hub development, broader aerotropolis development rests on its physical Internet for moving business and leisure travelers quickly and

efficiently over long distances; i.e., its passenger route networks. Success or failure also often rests on the quality of land access including availability of developable land and surface transportation access between this land and the airport. Addressing this challenge for Ekurhuleni will be a particular focus of Chapter 2.

This access is why for many of the more prominent aerotropolises such as Dallas-Ft. Worth, Amsterdam, and now even Paris, the highway corridor connecting their airports to the central city has been a leading aerotropolis development driver. In fact, it is often said that in aerotropolis development, the three "A's" (accessibility, accessibility, accessibility) have replaced the three "L's" (location, location, location) as the most important factors attracting aerotropolis business siting (demand) and impacting commercial real estate values. Since accessibility is also enhanced by commuter and rapid rial passenger connectivity to the airports, those such as Amsterdam, Frankfurt, Hong Kong, and Paris Charles de Gaulle have been able to boost their airport land values and develop highly successful airport cities near their passenger terminals.

The geographic position of the airport and its surrounding aerotropolis with respect to the outward development path of the metropolitan central city is likewise an important success factor. As noted previously, and will be illustrated later, a number of aerotropolises such as the Washington Dulles Aerotropolis experienced commercial real estate development advantages because

Washington, D.C. expanded most rapidly in direction of Washington Dulles International Airport, eventually reaching it and developing around it. The same happened with Chicago's O'Hare International Airport, Denver International Airport, and Paris Roissy generating additional land value and business sitings near these airports.

On the other hand, the City of Atlanta's main growth axis was for decades in the opposite direction of Atlanta Hartsfield Jackson International Airport. Despite being the world's busiest airport with over 90 million passengers expected to pass through it in 2011, aerotropolis development around Atlanta's airport has been more limited than we would have expected based on its air connectivity and passenger volumes.

The planned Kansas City Aerotropolis has also been beset by a number of challenges. First, its economic region may not be sufficiently strong to support a critical threshold of aviation-dependent business activity nor does the airport have the critical mass of air routes to generate appreciable levels of commercial activity. Second, the airport is sufficiently distant from densely-populated residential areas to make labor recruitment difficult for businesses located near the airport. Third, although the Kansas City economy has been relatively good, there is not a large need for new commercial space. That which exists seems to be more suitably served by piecemeal developments in and near the city itself.

Asian aerotropolises are unique in that each was shaped by a new greenfield airport, with Singapore's Changi at just over 30 years being the oldest among them. These new airports were built because of capacity constraints at existing airports and each was a central component of national strategies to maintain global competitiveness in the face of increased pressure from other Asian regions. Rapid processing of passengers and cargo along with attractive terminals has helped Changi maintain its position in the face of a less-than-ideal location and competing hubs in Malaysia and Thailand. The same has helped Hong Kong International Airport grow its role as the air gateway to Southern China. Similarly, Incheon and the surrounding developments are part of a strategy to help Korea not become a mere flyover zone in Northeast Asia.

Apropos the above, infrastructure support and the generous tax forgiveness programs for business operators at many airports is an indicator both of the level of government concern for future national economic development and of the challenges some, even large, airports face. Operating in increasingly competitive arenas, such government benefits have proven to be as important as airport efficiency in development success.

Two major European airports have largely followed the Asian lead. Frankfurt and Schiphol are two of the four largest European airline hubs (Frankfort, London, Amsterdam, and Paris). Frankfurt and Amsterdam are smaller and probably the lesser competitive cities of the four major hubs. Their

national governments have, therefore, been willing to think systematically about the role of their airports in national competitiveness to a degree not yet seen in London and Paris.

Unlike many other metropolitan regions, Dubai is almost purely a product of air transport. It acts as a central place and intermediary on one of the largest air cargo axes in the world—Asia to Europe—and as a passenger hub connecting first- and second-tier cities in Africa, Asia and Europe. This, along with huge investment in its national airline, Emirates, has not only boosted Dubai International Airport as one of the largest and fastest growing air logistics hubs in the world, but also has made Dubai as a whole an exemplary Aerotropolis. The same type of route development may be said to be the case (to a somewhat lesser extent) for Changi International Airport making the entire Singapore city-state a successful 21st century Aerotropolis. In such cases, close strategic alliances and coordinated planning between the national flag airline and its hub airport brought competitive advantages to both.

The role that the central government has played in the success of Aerotropolis development in Dubai, Hong Kong, Singapore and elsewhere such as Helsinki Aviapolis cannot be overstated. This is why obtaining the full Federal support (in the interest of South Africa's competitiveness) is critical. So is obtaining the strong cooperative support of the Gauteng Province and major metropolitan municipalities of Johannesburg and Tshwane that are part of the

extended aerotropolis area. Without the complete buy-in and support of federal government agencies and pertinent provincial and metropolitan municipality agencies, Ekurhuleni Aerotropolis success will be more difficult to achieve.

1.11 Airport-driven Commercial Components (both Inside and Outside the Airport Fence).

Let me conclude my discussion of commercial development with some generalizations. Airport area commercial growth is being shaped by (1) firms providing air transportation services, (2) firms that are frequent consumers of air transportation, (3) businesses that cater to the ancillary needs of air travelers and employees of the previous two types of firms, and (4) companies that may simply be searching for accommodating sites with good regional highway access. These various types of business activities create a ratcheting effect, accelerating inside the fence airport city and growth and broader outside the fence (Aerotropolis) growth in a largely organic manner.

The spatial and functional core of the Airport City is the passenger terminal which may be likened to an urban central square. It operates as its multimodal commercial nexus offering a variety of retail goods, food and beverages, and services primarily to airport passengers. Urban functions such as offices, hotels, exhibition complexes and distribution facilities evolve near the

terminal, creating a city-like environment at and immediately around the airport. As aviation-linked businesses locate further outward, primarily along connecting transportation corridors, a more expansive Aerotropolis (airport-integrated urban economic region) takes shape.

Based on the cases above and airport city and aerotropolis benchmarking conducted by the Kenan Institute, Exhibit 1.60 specifies the most common locations of airport-linked commercial elements based on whether they are people-oriented or goods-oriented.

Exhibit 1.61 places many of these commercial elements on a schematic from similar research by the Kenan Institute following the evolution of functions at and around hub airports world-wide over the past 15 years. No single airport area is evolving exactly like this but they are all slowly developing similar commercial location patterns. Those airports surrounded by decades of prior development rarely reflect this form but their more recent business locations do follow the spatial patterns in Exhibit 1.61. This is, thus, the future of airport area land use and commercial development.

1.12 Ekurhuleni Aerotropolis Potential: Credibility, Viability and Transferability of Successful Experience from around the Globe

This introductory chapter presented the competitive rational and business case for a Ekurhuleni Aerotropolis, including a discussion key commercial components of Aerotropolises around the world and their economic impacts. It also provided descriptive information to see how ORTIA and Ekurhuleni stack up compared with existing and planned commercial development at and around selected international airports which are following Airport City and Aerotropolis models.

In terms of airport passenger and cargo volumes and Aerotropolis development, ORTIA is not a Dubai, Hong Kong International, or Incheon where 21st century global mega-hubs and surrounding development were planned and implemented on a blank canvas with highly supportive central governments and few environmental or social factors considered. Nor does ORTIA have the over 5,000+ hectares of open developable property on and around it like Dallas-Ft. Worth or Kansas City International Airport have.

ORTIA is currently a mid-sized international hub more like Detroit, Helsinki, or Taiwan Taoyuan where considerable development in the broader airport area occurred decades ago and where future aerotropolis planning and

development must mesh with older commercial/industrial mixes and nearby older ground transportation infrastructure.

What ORTIA (and Ekurhuleni) does possess is the leading African air gateway situated in one of the world's most favored economies. Its greater provincial economy is the fourth largest on the African continent (following South Africa, Egypt, and Algeria) and it sits at the epicenter of the continent's financial, manufacturing, and corporate headquarters activity. Indeed, with the most extensive air network in Africa, ORTIA's effective catchment area extends well beyond South Africa.

Currently, the vast majority of South Africans who travel internationally fly through ORTIA as, in fact, do most of those flying domestically. With South Africa's expected economic growth and rising per-capita incomes over the coming decades, both international and domestic travel are expected to rise considerably. These travelers will include millions of foreigners who will be flying to South Africa for business or pleasure. Many of them will be staying at Ekurhuleni area hotels and purchasing area goods and services as well as conducting business, touring, or attending meetings throughout the Gauteng Province.

Also fueling ORTIA and Ekurhuleni Aerotropolis development will be expanding numbers of South African business executives and professionals based in Gauteng Province who will be frequent air travelers. Thus, growing

numbers of foreign managers and professionals taking to the sky through ORTIA will be complemented by increasing numbers of native managers and professionals as many of South Africa's domestic firms go international. Ekurhuleni's extensive road and passenger rail connectivity reinforced by ORTIA's air network will make the airport area an increasingly attractive site for office locations and business meetings of both groups of air travelers.

To accommodate anticipated passenger (and cargo) growth, ORTIA's runway infrastructure and terminal facilities will be substantially expanded. Connecting rail and highway infrastructure is likewise being improved and expanded. When high-speed rail stations come to ORTIA in future decades, a leading central business district is likely to form at and around the airport, spawning further commercial development in Ekurhuleni and outward along and near airport transit corridors.

The above factors when taken together provide highly promising prospects for a Ekurhuleni Aerotropolis. I see no reason why virtually all the commercial components that have developed at the major airport cities and aerotropolises described in this chapter cannot profitably develop at and around ORTIA and outward.

Bolstering Ekurhuleni Aerotropolis prospects is the fact that the both ACSA and Ekurhuleni officials understand the Aerotropolis model and its potential. Provincial and national leaders are also grasping the potential of the

Aerotropolis model for business competitiveness and broader provincial economic development and South Africa's competitiveness. They all are therefore lending their full support (and leadership) to moving the Ekurhuleni Aerotropolis forward.

There are challengers, however. Words of support do not always mean collaborative actions. Much more effort has to be put into integrated planning across municipal, provincial and federal levels as well as with the private sector. Those will be spelled out in more detail in the following three chapters. Moreover, although Ekurhuleni roadways are improving and choke-points being addressed, conditions near ORTIA and on its connecting airport highway corridors and secondary roads close to the airport remain congested. There is limited open land for new development near the airport and much of what is developed is inappropriate. Planning is being done for such locations as Rhodesfield to redevelop the area commercially so that it will better leverage and be better leveraged by ORTIA. Likewise, ORTIA has an ambitious commercial master plan to develop airport cities on four of its key precincts. Rhodesfield and ORTIA western precinct projects must be better integrated along with other more integrated ORTIA–Ekurhuleni planning if the full potential of the aerotropolis is to be achieved.

Apropos the above, whereas an ORTIA Airport City and Rhodesfield conceptual commercial plans have been set forth to date, rigorous, credible

demand forecasts for their proposed facilities and uses are required. Otherwise, unnecessary risks and costly investment mistakes by ACSA and Ekurhuleni could occur, including oversaturation of certain types of commercial facilities. This will be addressed in some detail in Chapter 3.

Another challenge is implementing fast-cycle logistics processes at ORTIA and its surrounding Ekurhuleni Aerotropolis. Logistics, supply chains, and cargo (their material component) are far more important to airport and Aerotropolis success than many recognize. In fact, as noted, they have been the key initial drivers of the most successful Aerotropolises such as Dubai, Hong Kong, Incheon, Memphis, and Paris, among others.

It is therefore essential that ACSA and Ekurhuleni officials fully appreciate what logistics and cargo mean to making airline routes profitable and generating both inside the airport fence (Airport City) and outside the fence (Aerotropolis) development. Much of my strategic roadmap that follows will describe how to make ORTIA and the Ekurhuleni Aerotropolis a multimodal air logistics hub and magnet for high-value goods processing businesses whose supply chains depend on air cargo.

These and other key features of a Ekurhuleni Aerotropolis Strategic Roadmap will be explicated in the chapters which follow along with their underlying hard and soft infrastructure, facilities and supporting services. The overarching objective is to simultaneously strengthen ORTIA's, Ekurhuleni's and

Gauteng's competitive advantages while fostering more successful ORTIA Airport City, Ekurhuleni Aerotropolis, and greater Gauteng Province economic growth.

Let me conclude this chapter with a pertinent sidebar. While the aerotropolis is appropriately and most often viewed as a physical constellation of infrastructure, facilities, and technologies to foster an area's competitiveness and growth, it is much more than that. The aerotropolis is, in fact, a long-term strategy to enhance community prosperity by also making the airport and the areas around it more economically efficient, attractive, and environmentally and socially sustainable.

The aerotropolis strategy accomplishes this by implementing a reinforcing constellation of institutional interventions which upgrade local assets (including labor) and reduce ground-based costs(including crime) to better leverage air-enabled trade in goods and services to attract private-sector investment and create jobs for those at all rungs of the socio-economic ladder. It is a process that requires passion, perseverance, and patience, but the ultimate rewards are rich and broadly distributed.

Just remember than that you are commencing a marathon, not a sprint. The real beneficiaries of the Ekurhuleni Aerotropolis will not be you, but your children and grandchildren.

Exhibit 1.1. iPhone Global Supply Chains

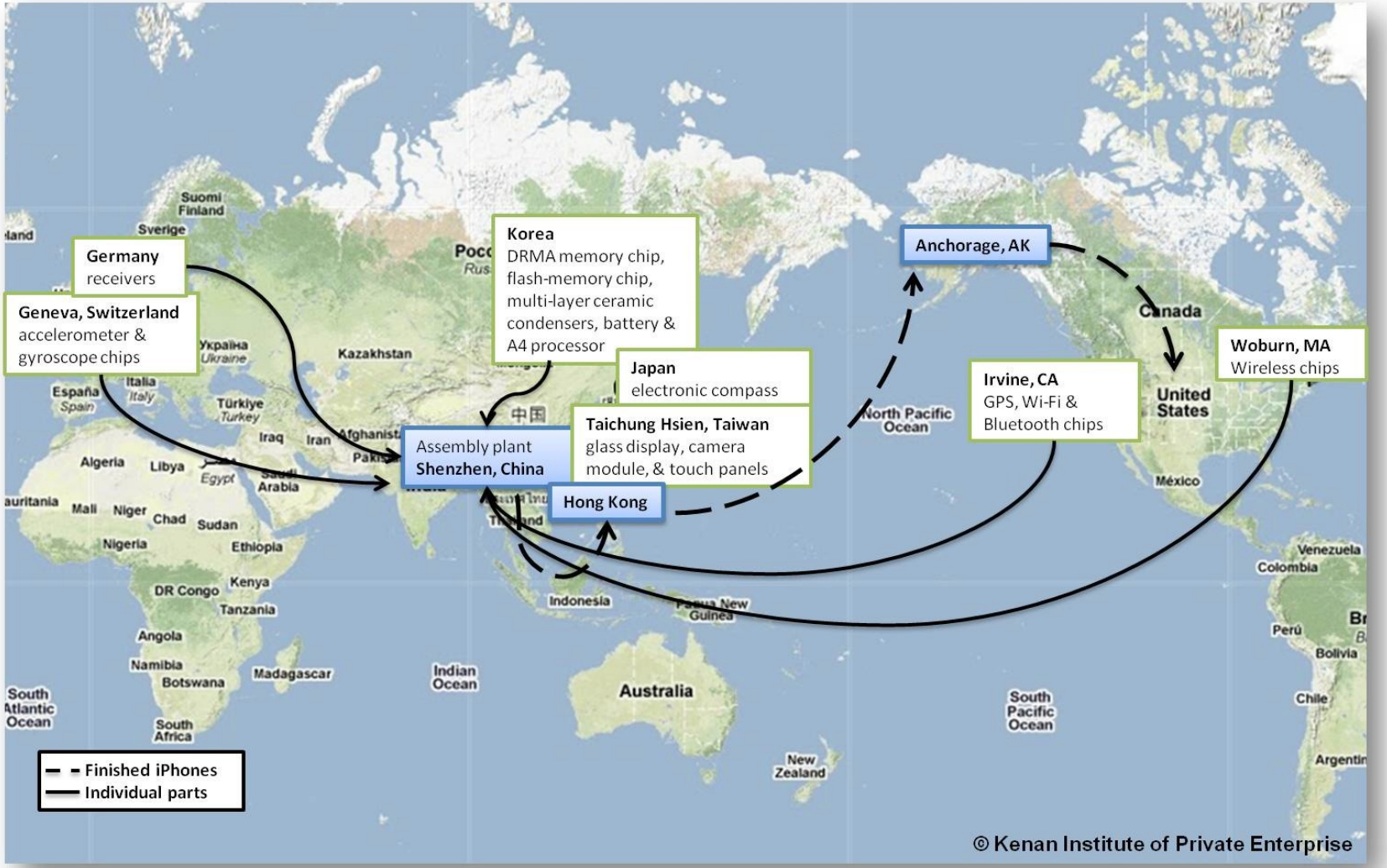


Exhibit 1.2. Global Air Transport, 1945-2010

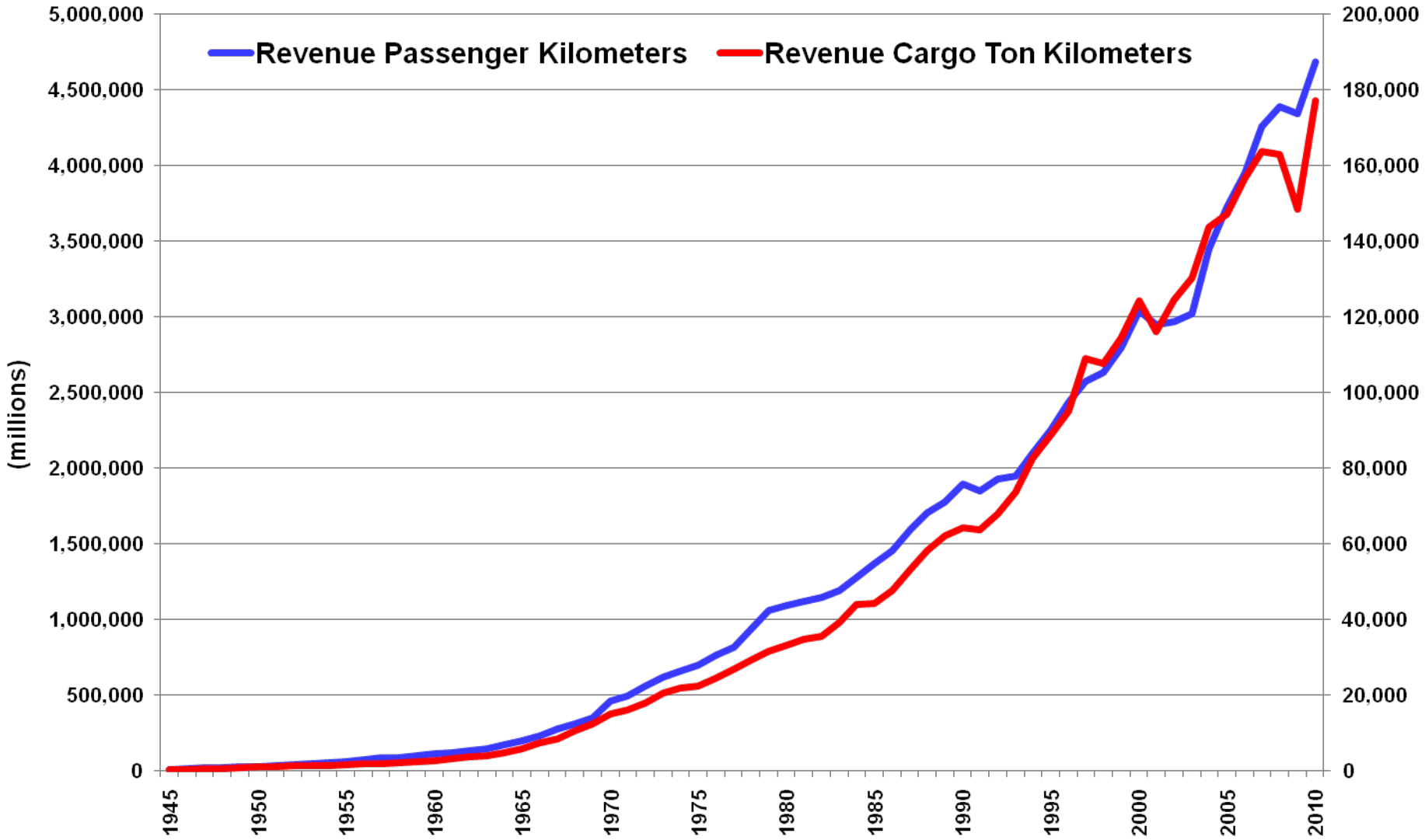


Exhibit 1.3. Roissypole: CDG's Airport City

- Business district located in the middle of the CDG platform: 216,000 m² of offices and 68,000 m² of hotels + 3 planned hotels
  - District linked with various terminals of Paris-CDG via light rail & people mover rail
  - Immediate proximity of the future T4
- Phases:
  - 2009 acquisition of Continental Square 1 and 2: 50,000 m²
  - Construction of an office complex (Continental Square 3) in 2012
  - Construction of new 3-star hotel

Exhibit 1.4. Paris CDG Sheraton Hotel Above High-Speed Train Station with Light Rail and People Mover Intermodal Access

Exhibit 1.5.EuroCAREX High Speed Rail Cargo at Paris CDG

Exhibit 1.6.CDG Airport Corridor to Paris

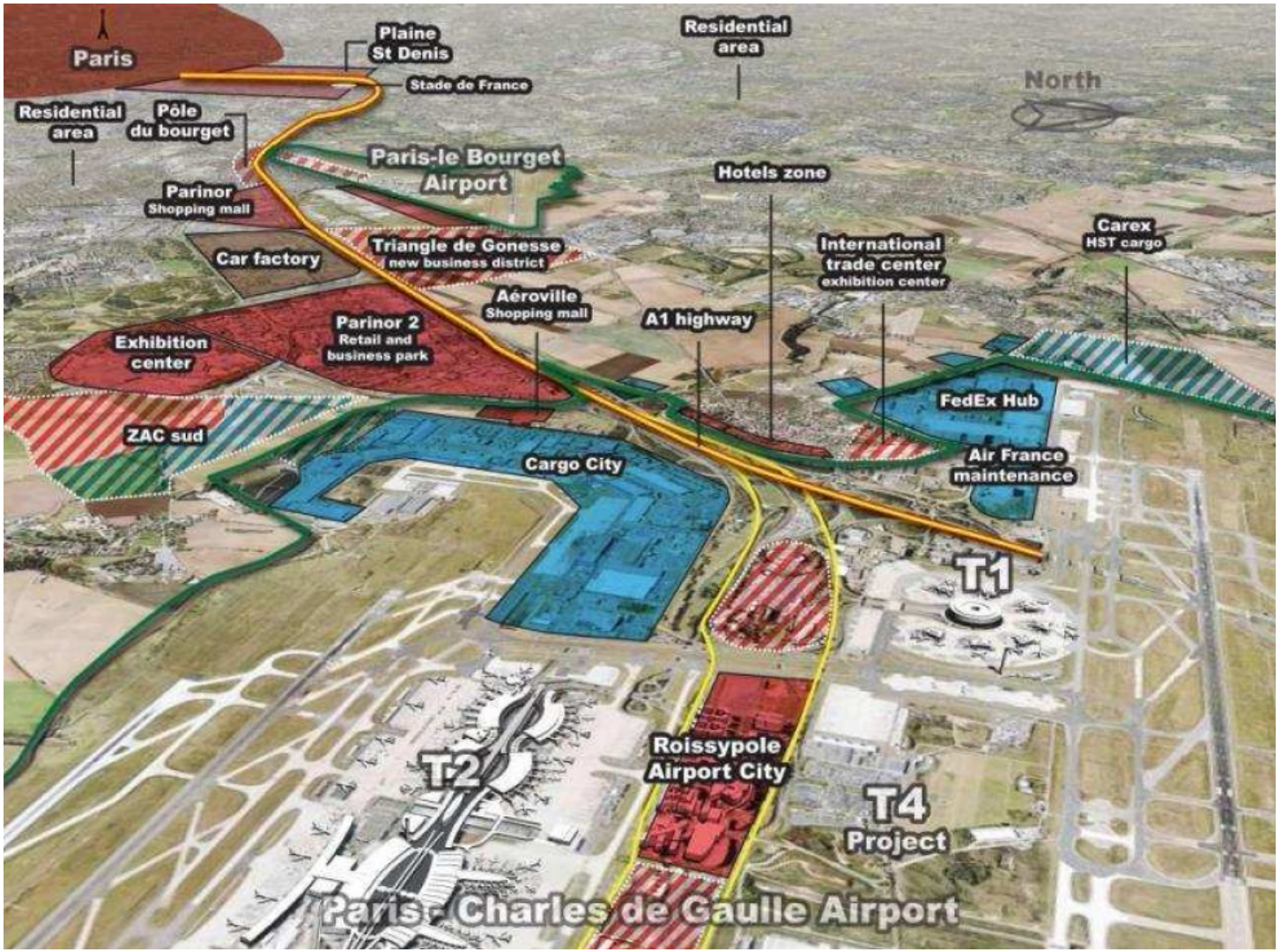
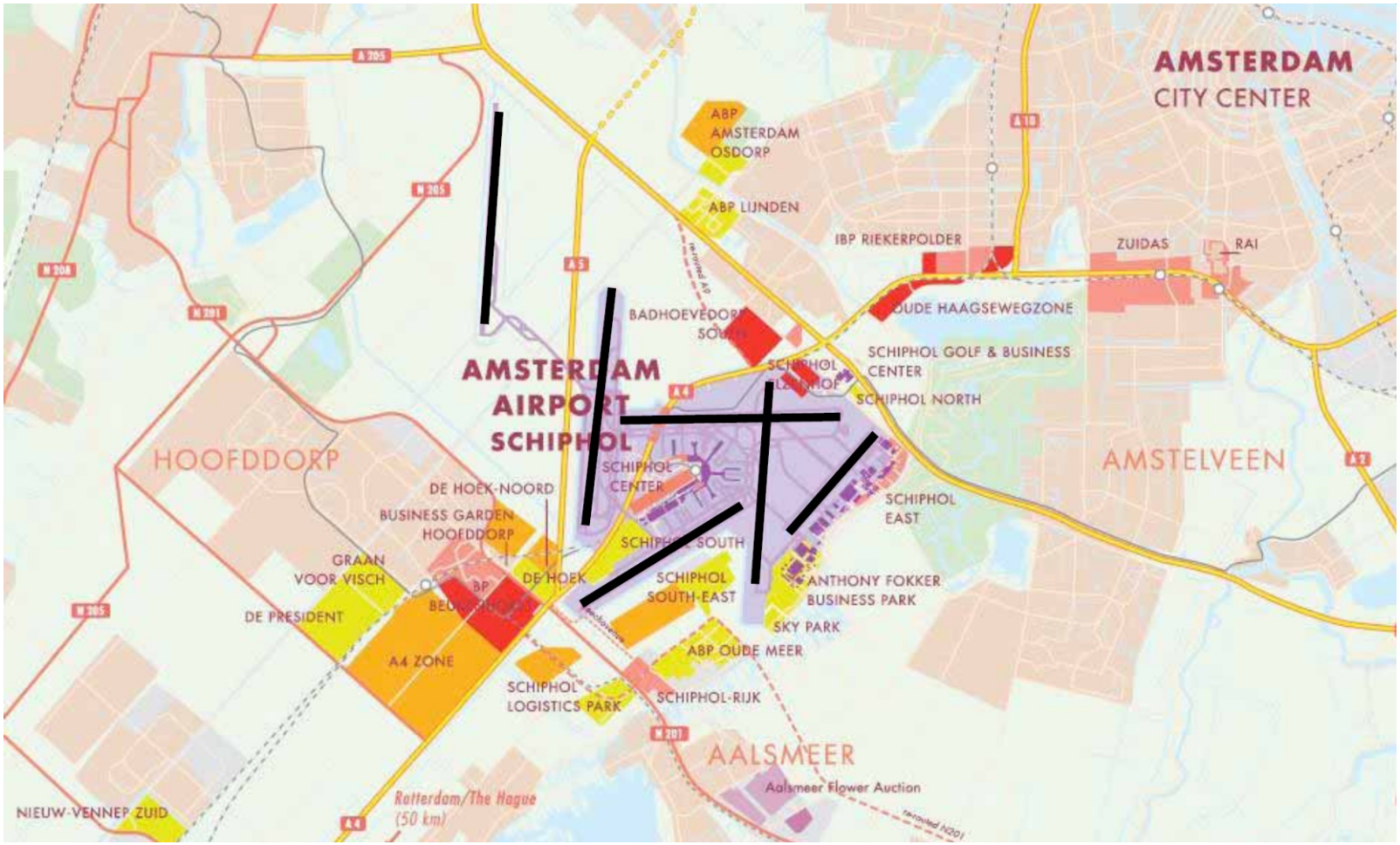


Exhibit 1.7. Amsterdam Schiphol Airport: Shopping

Exhibit 1.8. Amsterdam Schiphol Airport City World Trade Center, Corporate Offices & Hotels

Exhibit 1.9. Amsterdam Schipol Area Commercial Clusters



Source: NACO.

Exhibit 1.10. Amsterdam Schipol Airport City – Aerotropolis Synergies

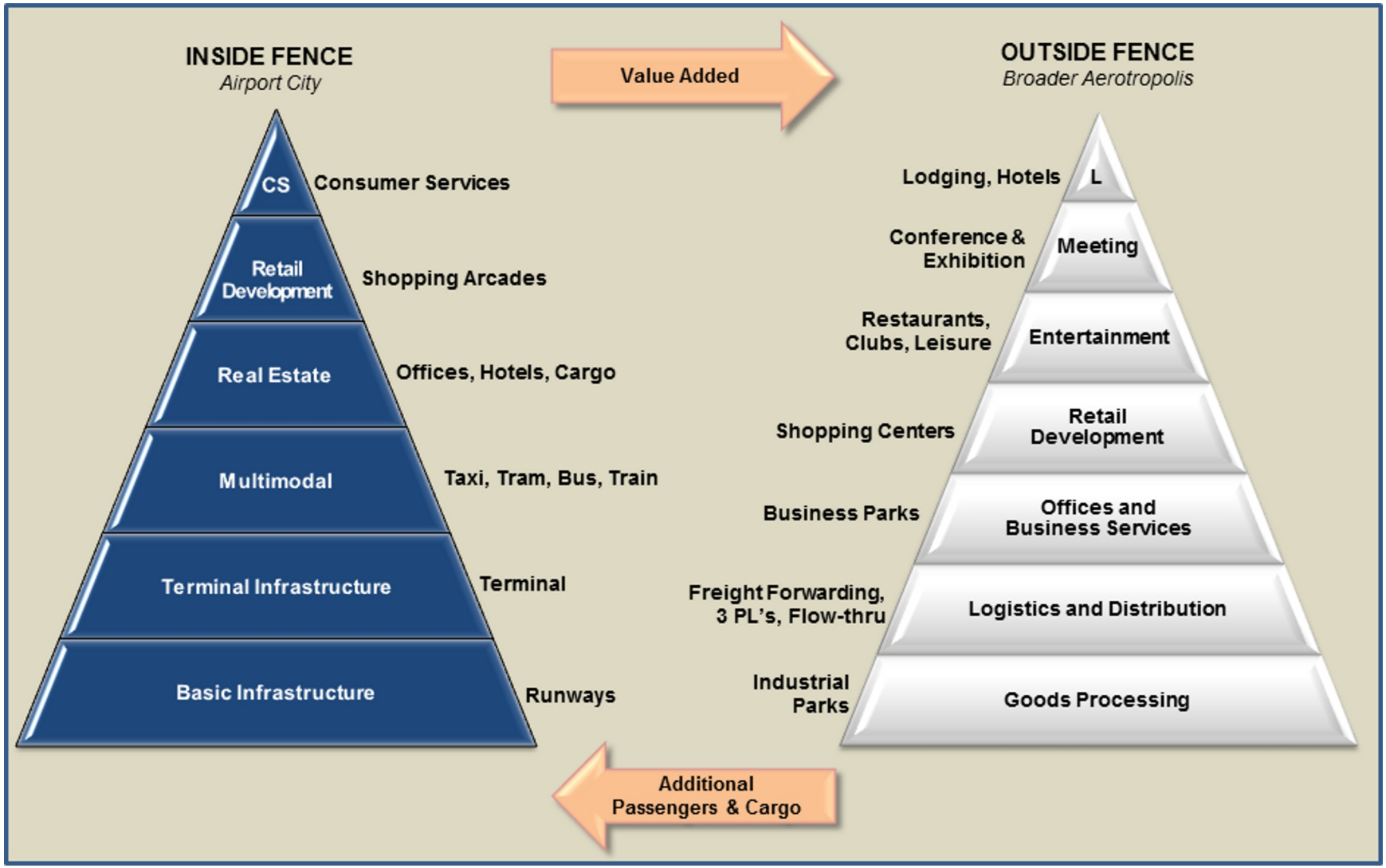


Exhibit 1.11. Amsterdam Zuidas: Airport Edge City

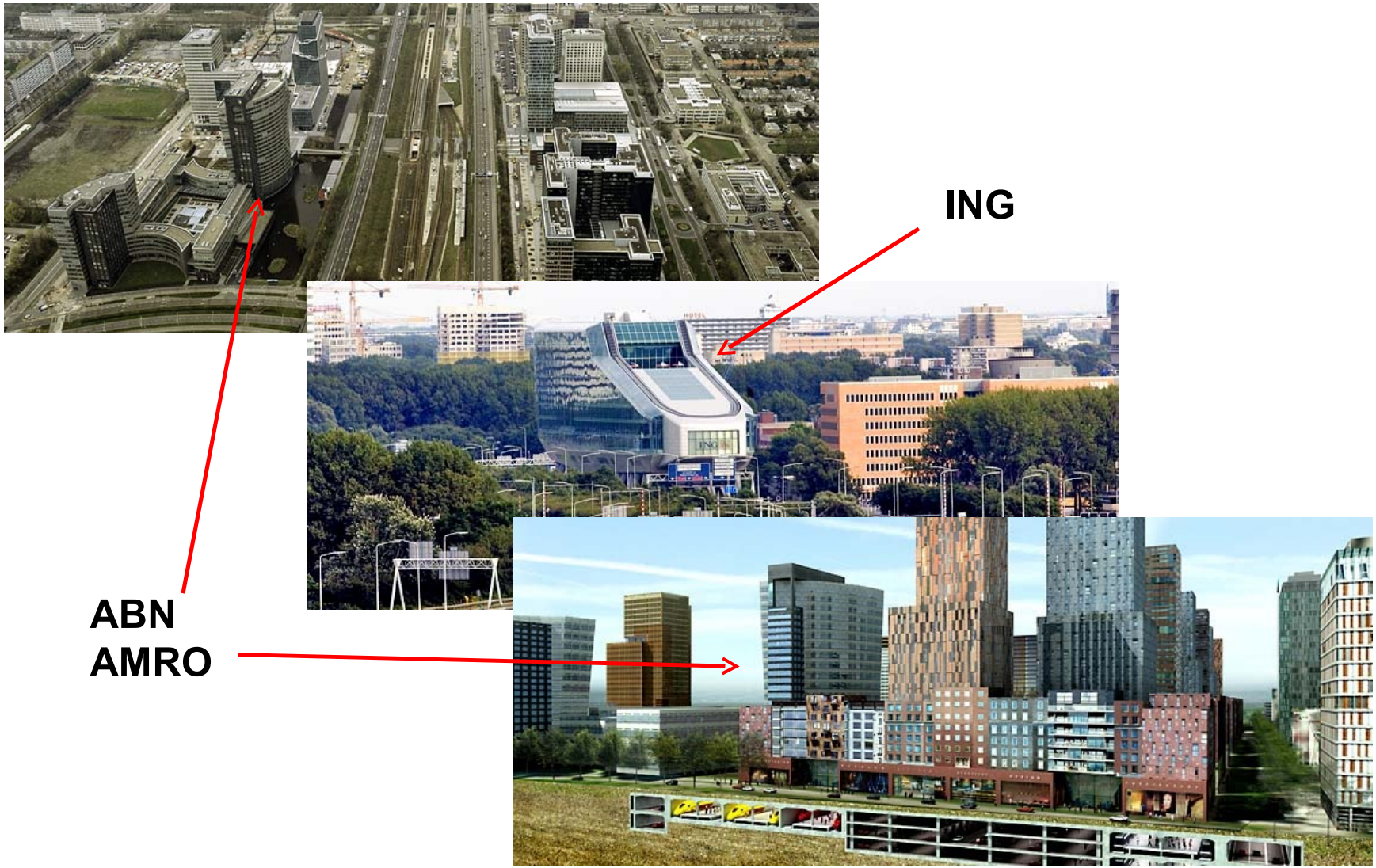
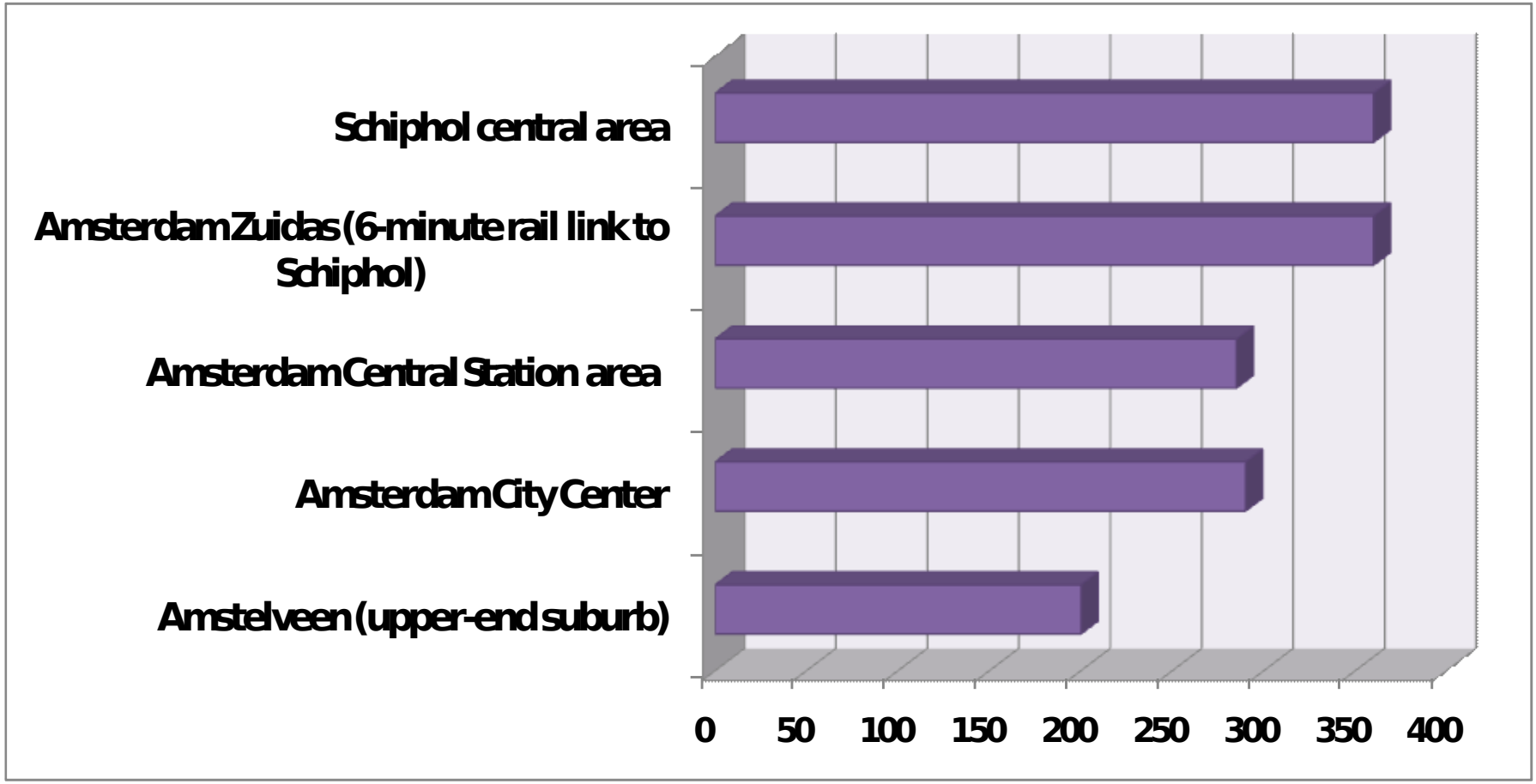
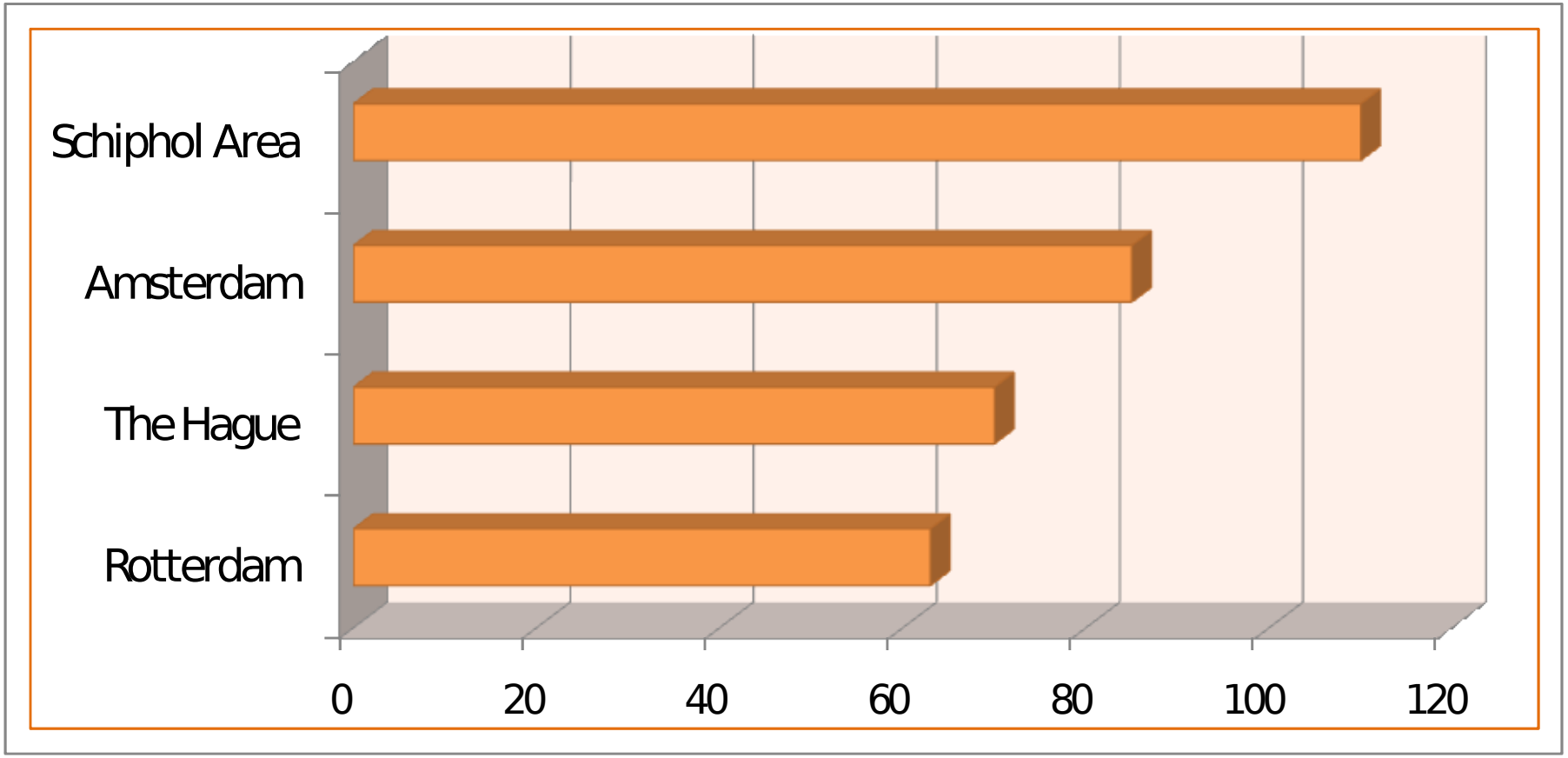


Exhibit 1.12. Amsterdam Comparative Office Rents – 2010, EU/m^2/yr



Source: DTZ Zadelhoff and Kenan Institute

Exhibit 1.13. Netherlands Comparative Industrial Property Rents – 2010, EU/m^2/yr

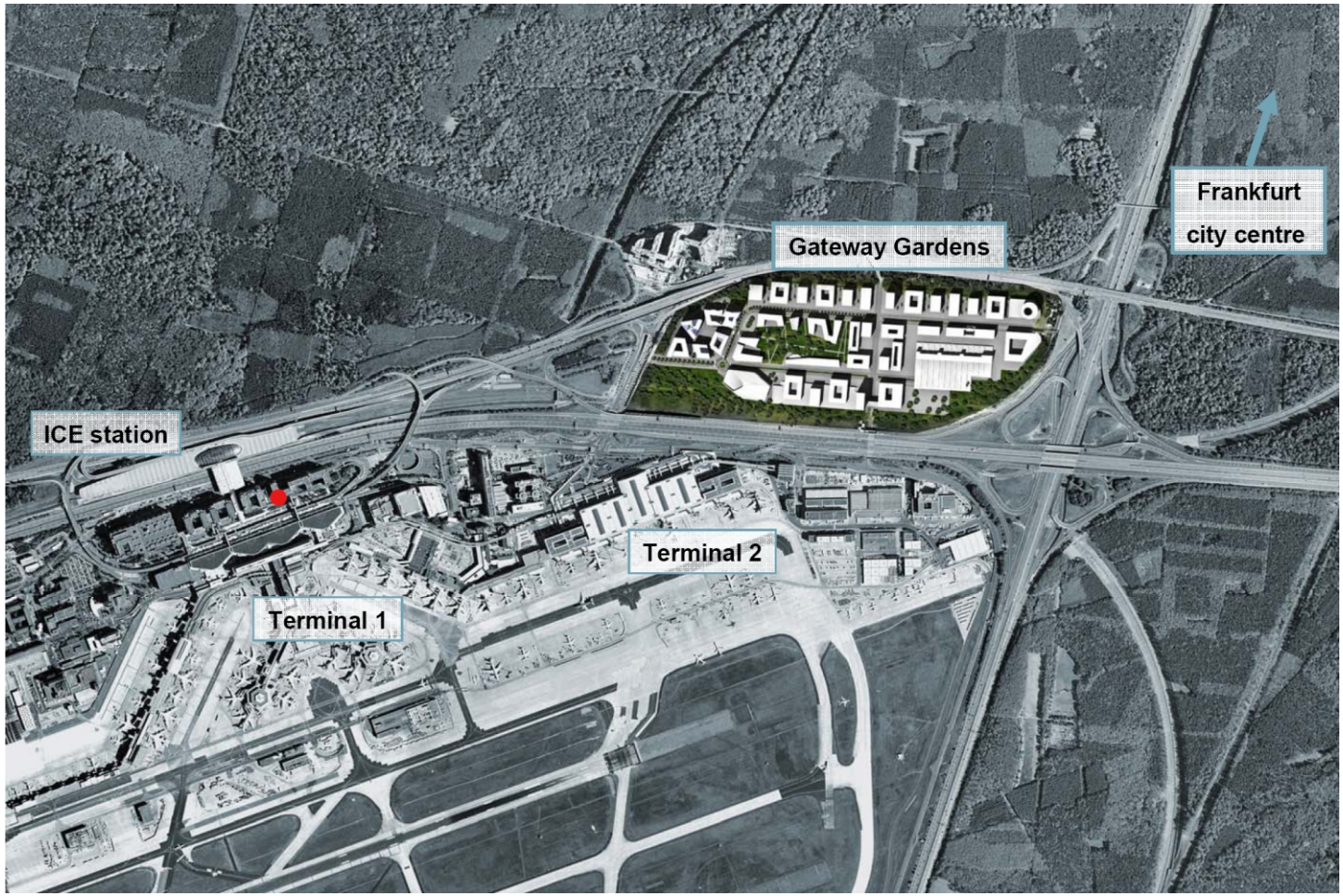


Source: DTZ Zadelhoff and Kenan Institute

Exhibit 1.14. Frankfurt Office Complex and Airrail Center

Airrail Center is now “The Squaire” – photo courtesy of
http://www.thesquaire.com/en/

Exhibit 1.15. Gateway Gardens Location



Source: Fraport

Exhibit 1.16. Gateway Gardens Planned Layout

Source: Fraport

Exhibit 1.17. Gateway Gardens Urban Spaces

Source: Fraport

Exhibit 1.18. Helsinki Aviapolis

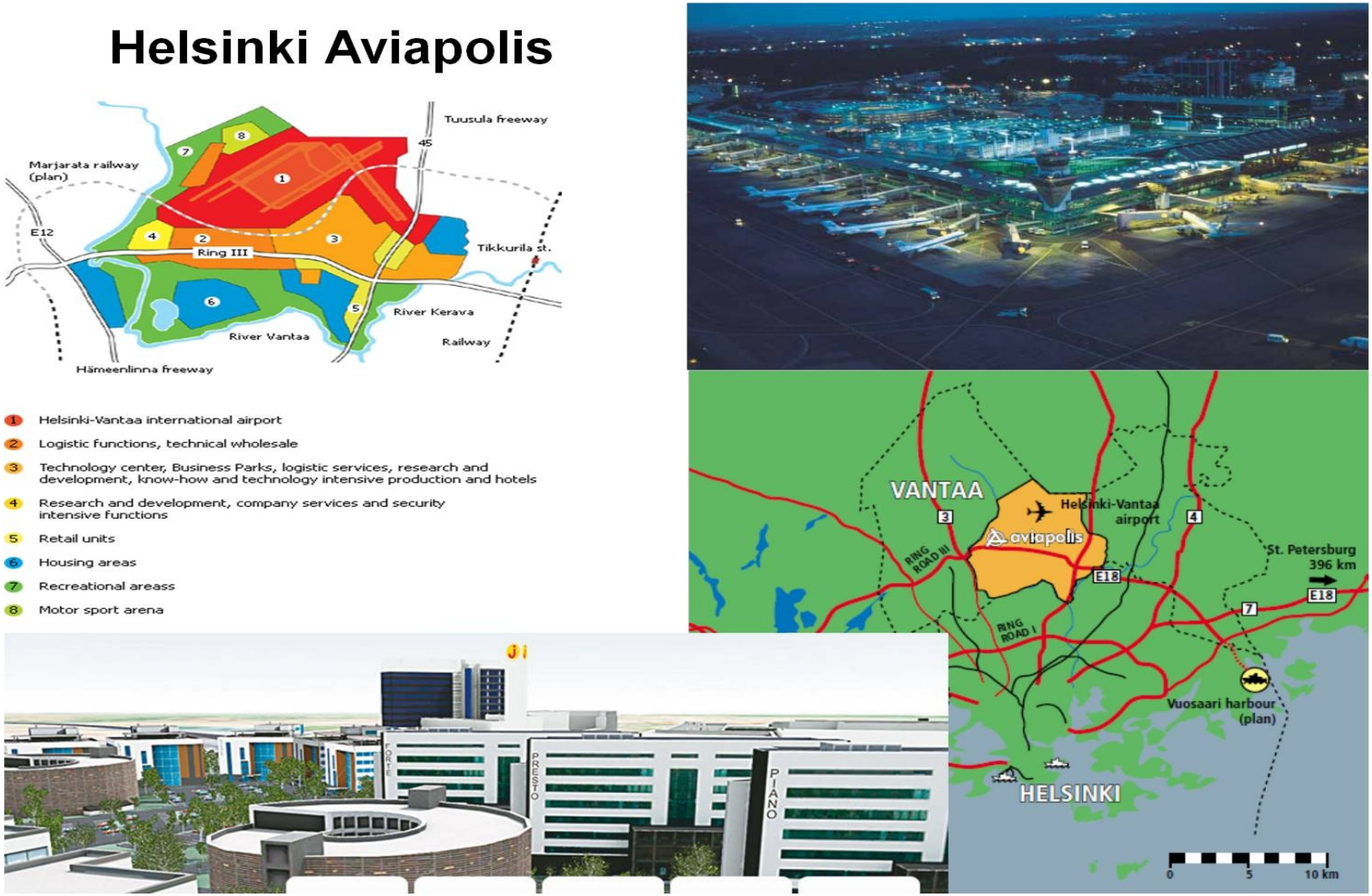


Exhibit 1.19. Aviapolis World Trade Center

Exhibit 1.20. Technopolis at Helsinki Aviapolis

Exhibit 1.21. The Station at Aviapolis

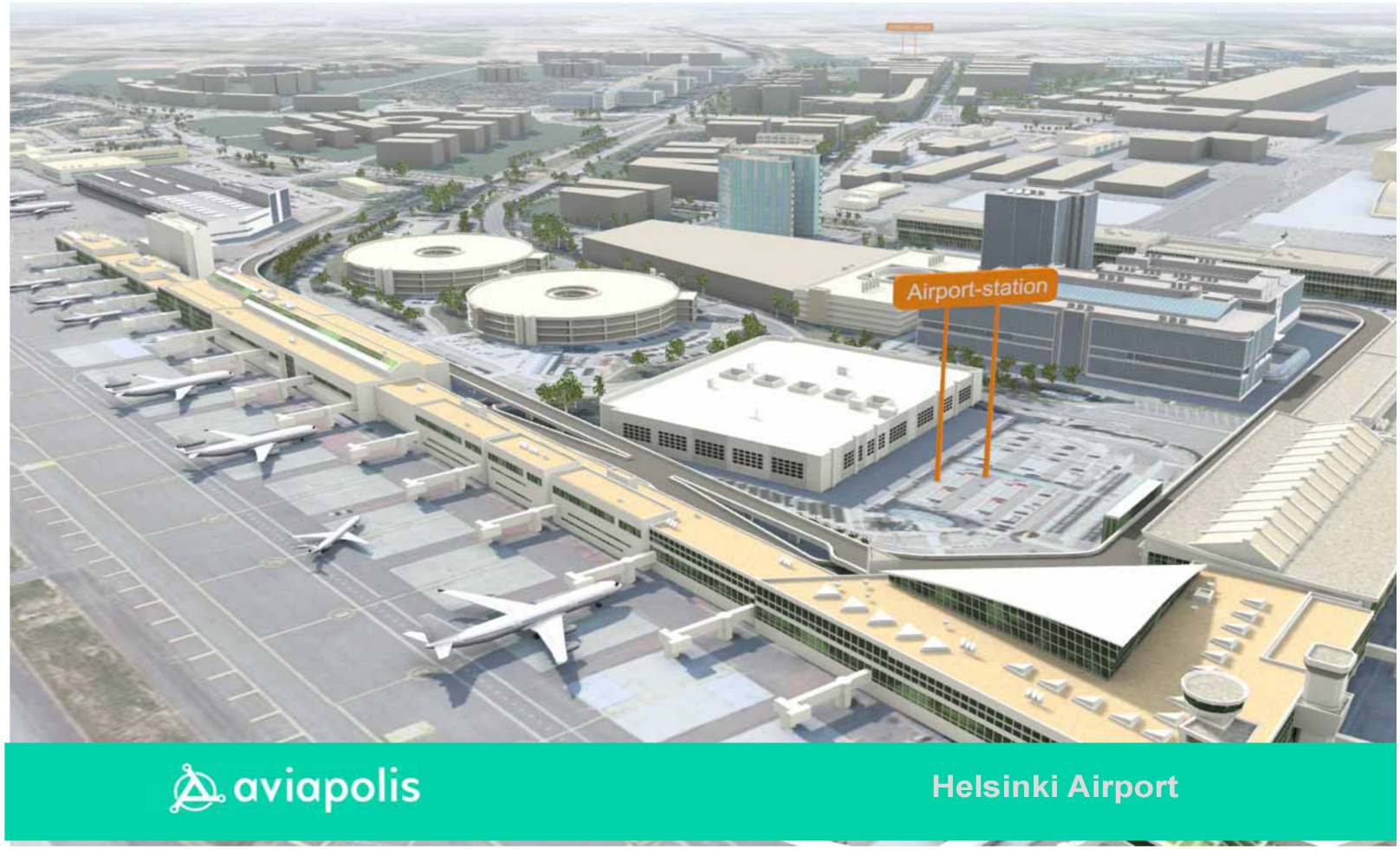


Exhibit 1.22. Aviapolis to Helsinki Ringrail

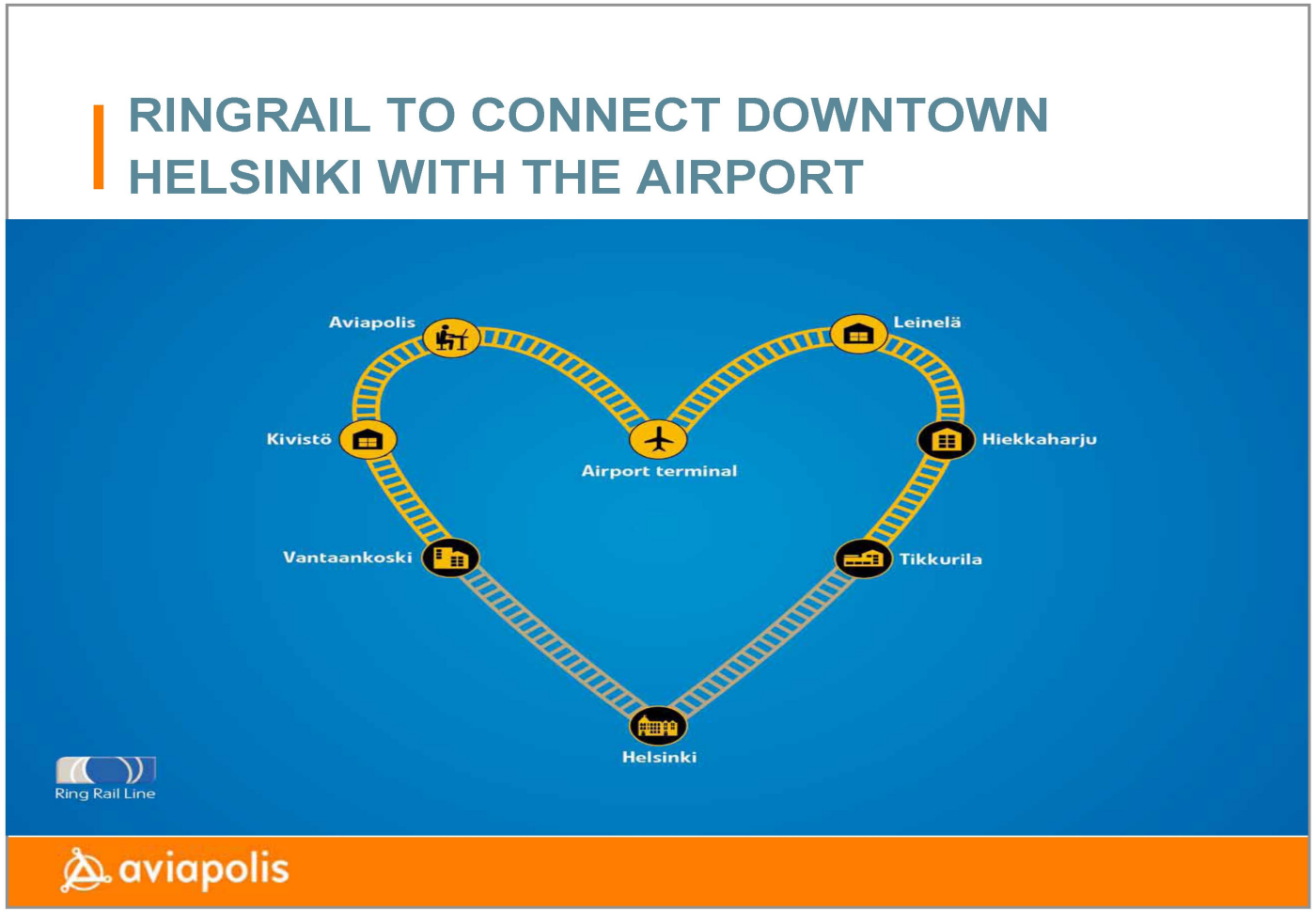
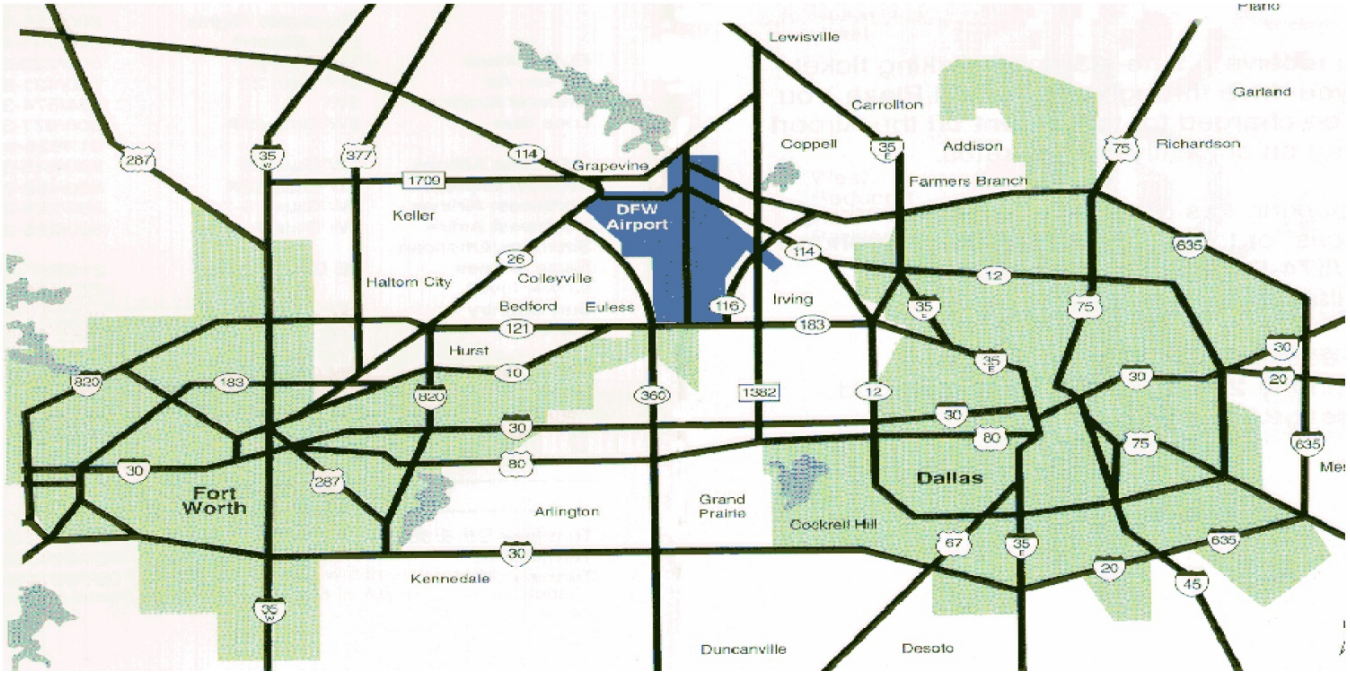


Exhibit 1.23. DFW Airport Overview—DFW Airport Is Located in between the Cties of Dallas and Fort Worth, and Is Larger than Manhattan Island



Source: DFW—An Airport City. April 25, 2007

Exhibit 1.24. DFW: 6 Key Commercial Development Areas

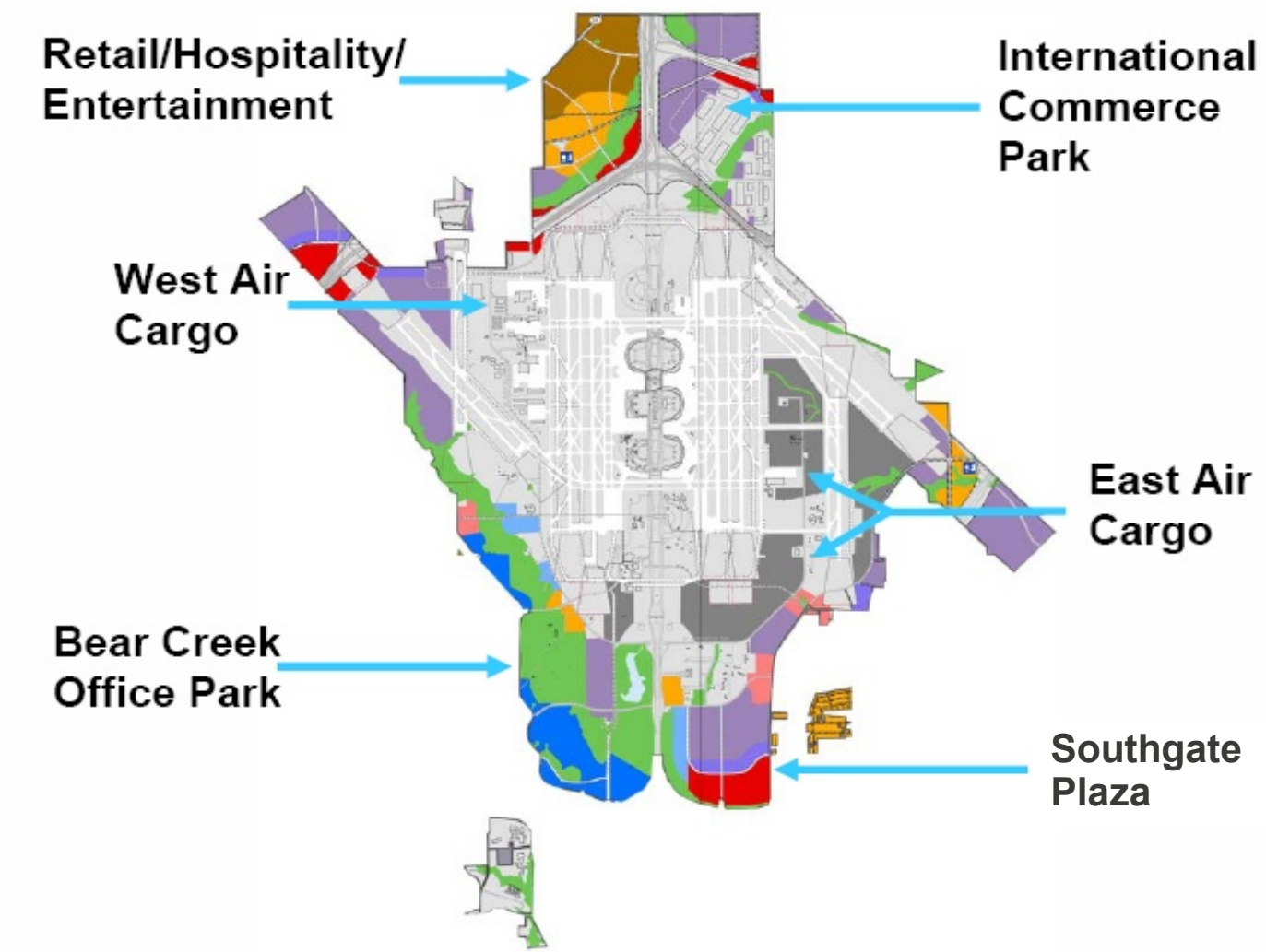


Exhibit 1.25. DFW—International Commerce Park

Industrial Freeway Commercial Flex Office

Exhibit 1.26. DFW—Retail/Hospitality/Entertainment

Retail/Hospitality/Entertainment Mixed Use

Exhibit 1.27. DFW—Bear creek Office Park

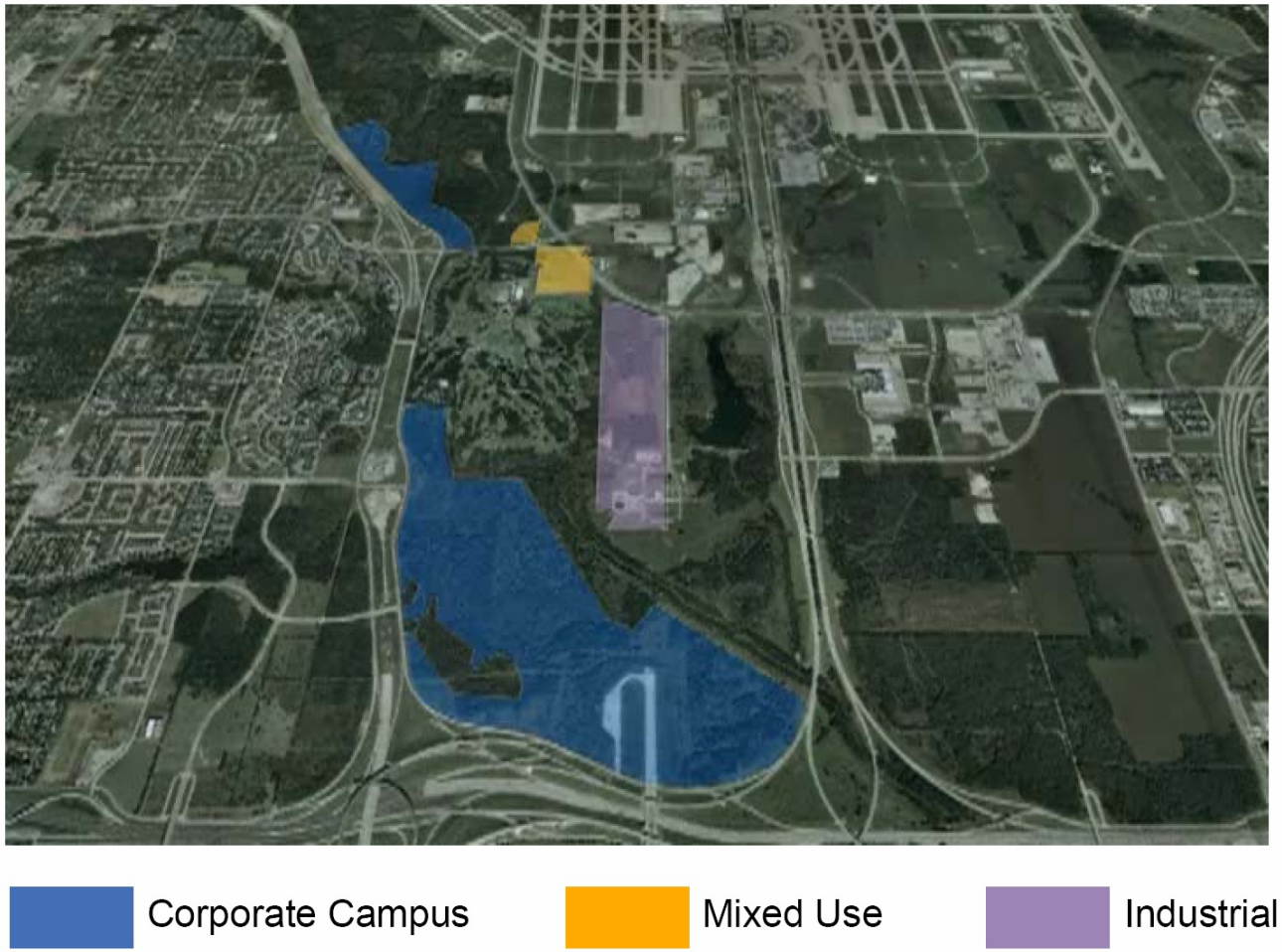


Exhibit 1.28. DFW— Southgate Plaza: 125-acre Area, Mixed-use Development Including Grand Hyatt Hotel, Offices, Restaurants & Shops

Exhibit 1.29. DFW - Future light rail, Commuter rail & High-speed Rail Lines Feed New Stations

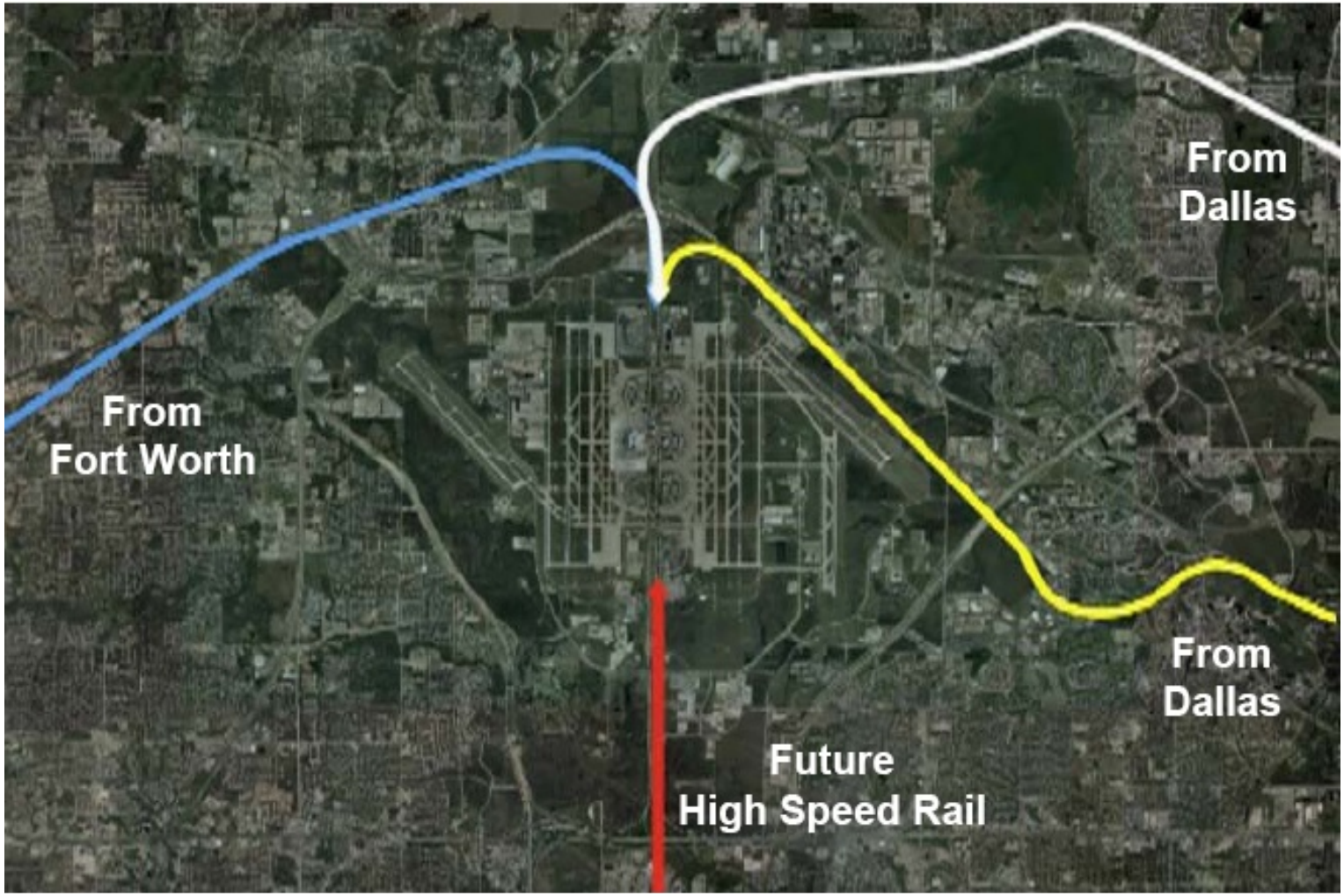


Exhibit 1.30. Comparative Economic Impact of Airports

Airport/City	2004 Passengers	Metro Population	Economic Impact
Memphis	10,883,759	1,250,293	$21 Billion
Denver	42,393,766	2,330,146	$17 Billion
Phoenix	39,504,898	3,715,360	$14 Billion
Minneapolis	36,713,173	3,116,206	$11 Billion

Exhibit 1.31. Memphis Aerotropolis Logistics and Distribution Clusters, 2005

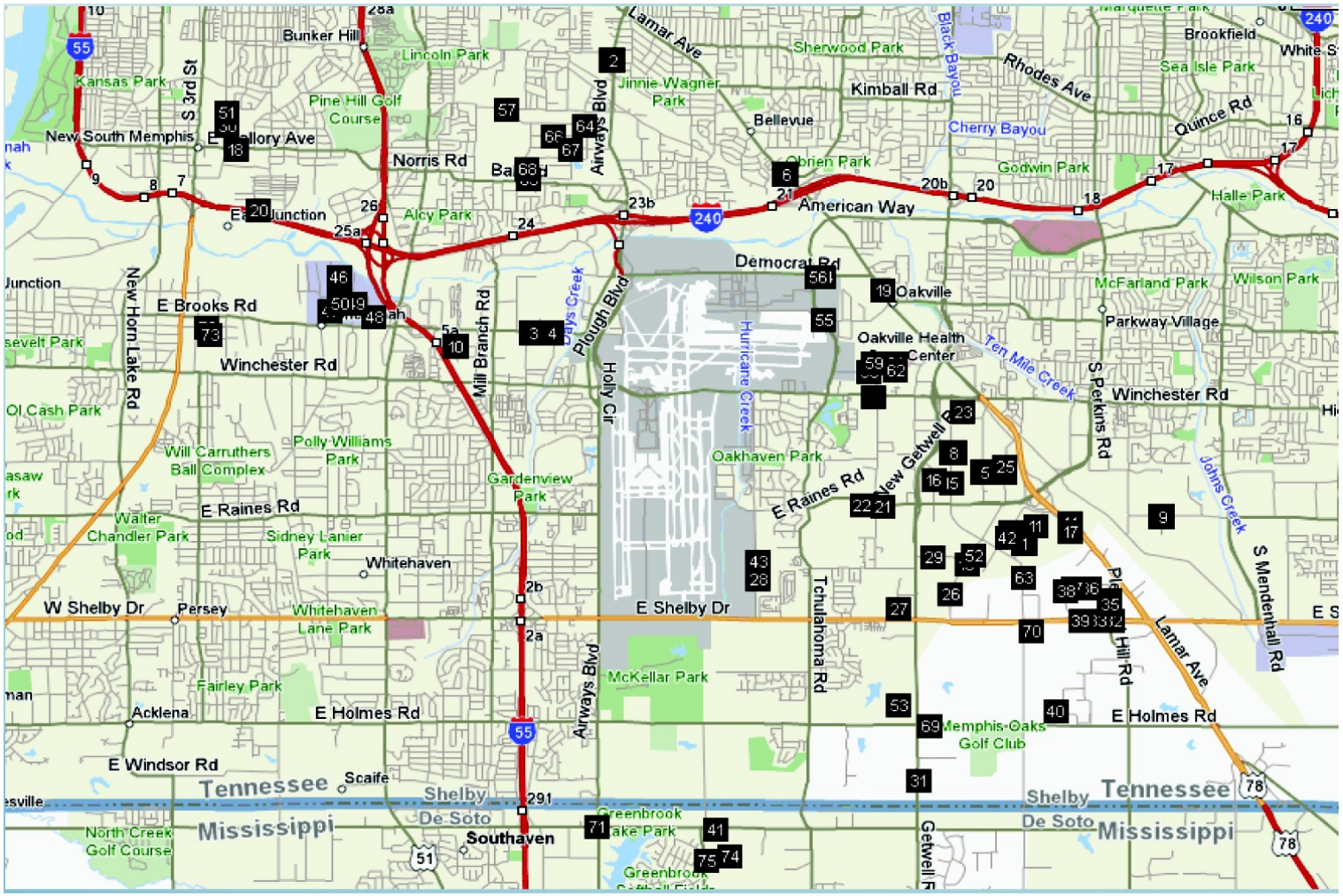


Exhibit 1.32. Memphis Distribution Facilities Near Airport, 2005

Exhibit1.33. Proposed Core of Detroit Region Aerotropolis: 25,000 Acres of Development Potential

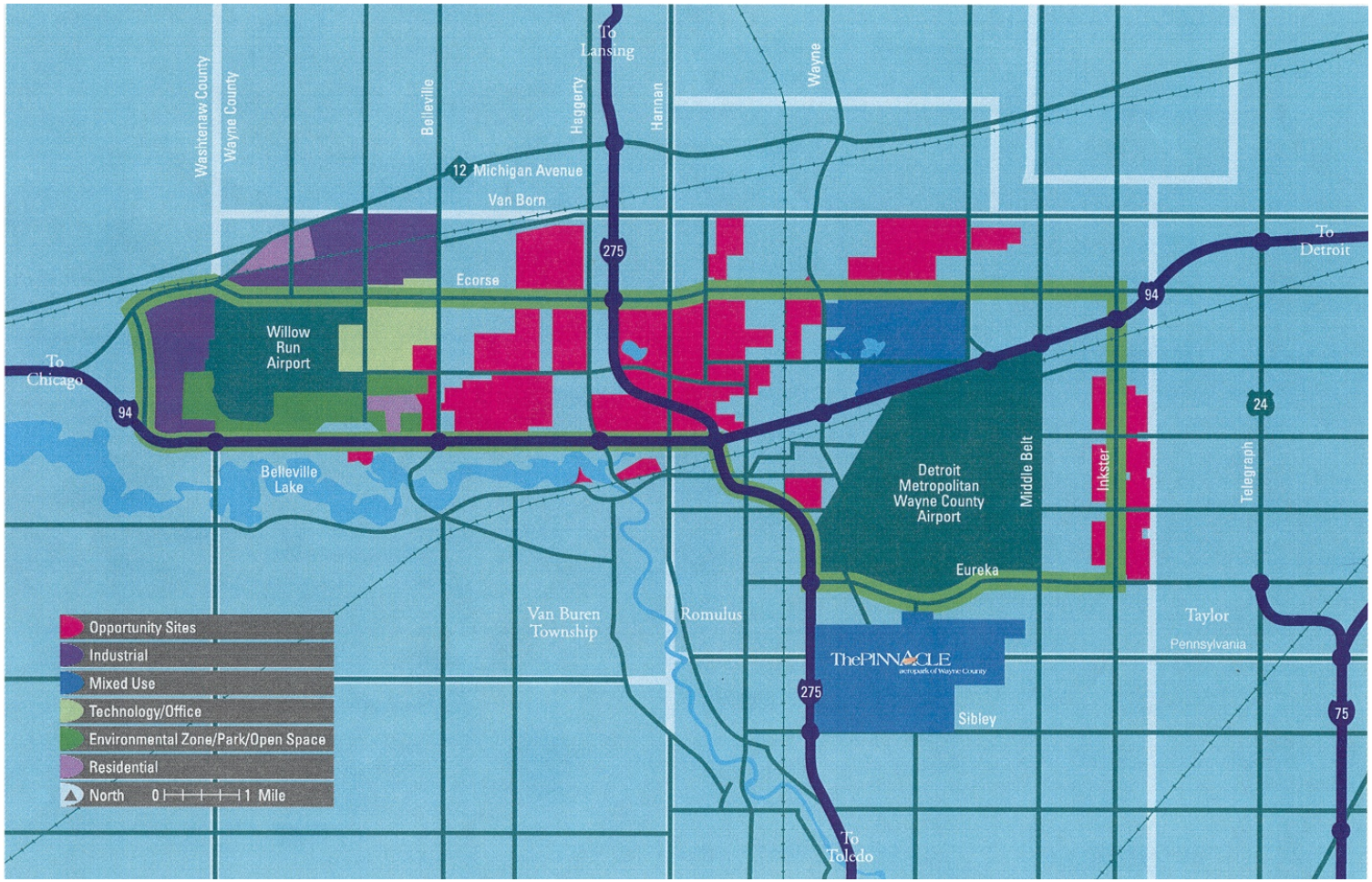


Exhibit 1.34. Detroit Region Aerotropolis Conceptual Model

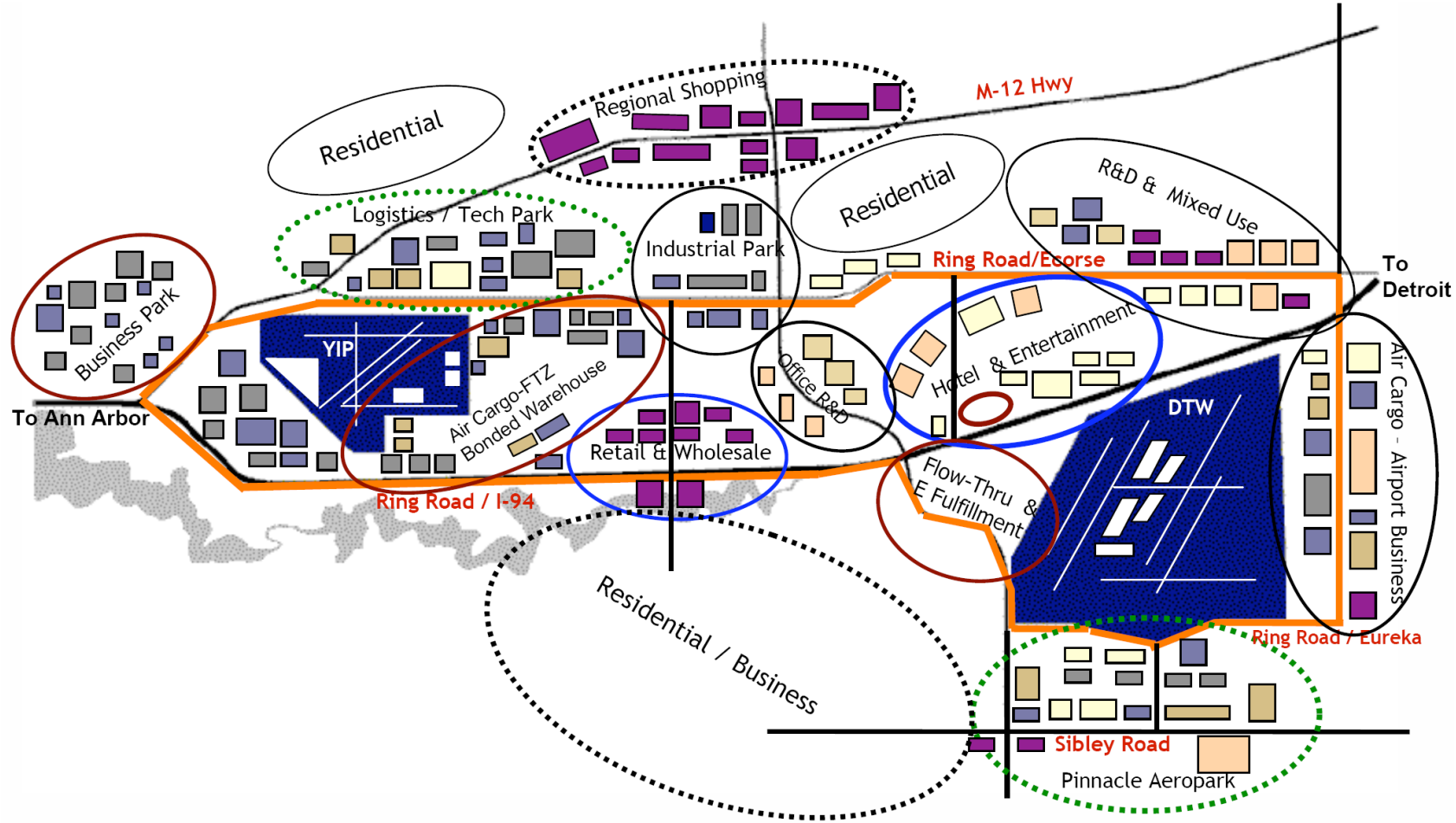
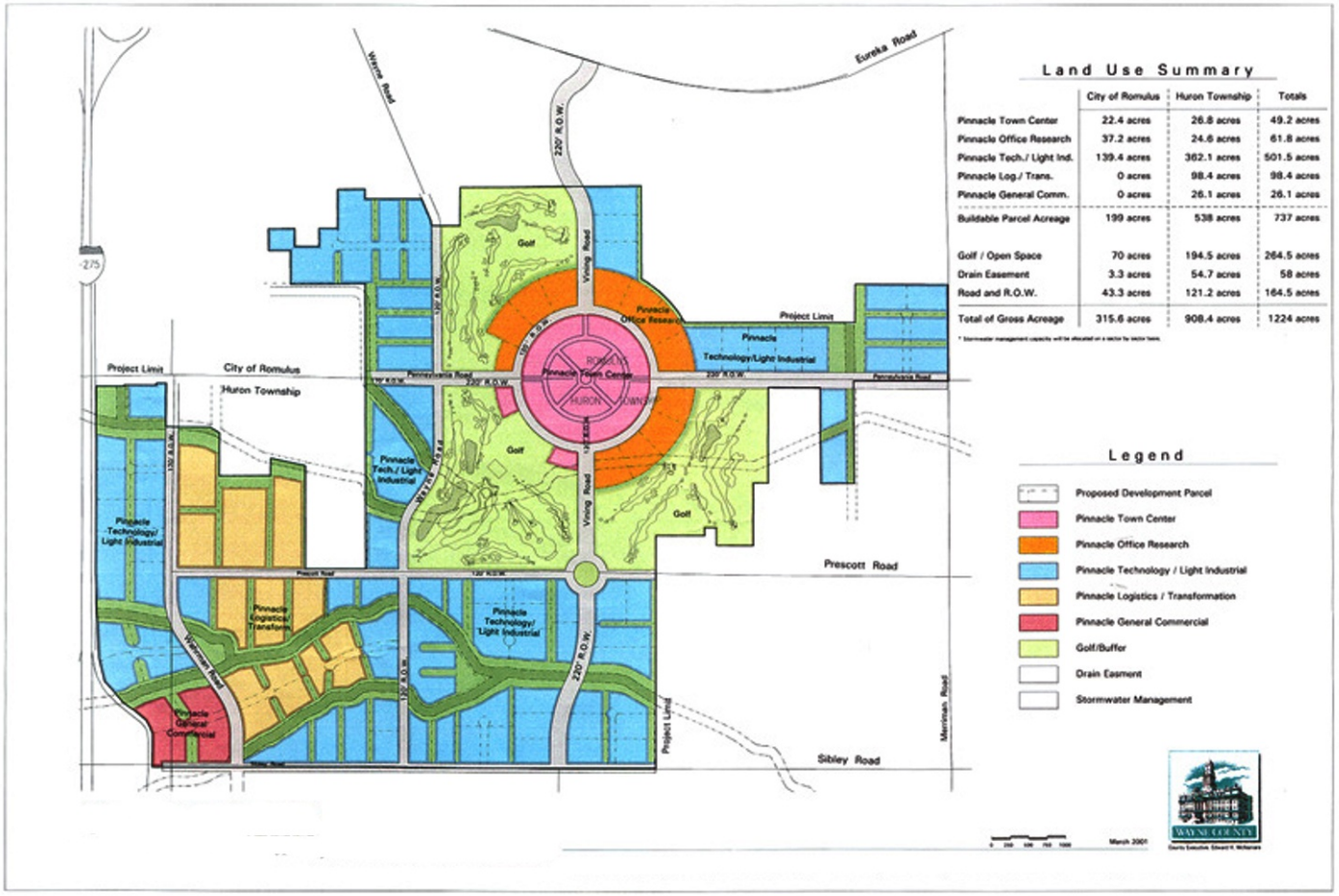


Exhibit 1.35. Pinnacle Aeropark: DTW's New Front Door

Exhibit 1.36. Aerial View of the Pinnacle Aeropark

Exhibit 1.37. Pinnacle Aeropark Commercial Clusters and Land Use



Source: Wayne County Departments of: Jobs & Economic Development / Airports / Public Services / Management & Budget; and SKW.

Exhibit 1.38. KCI Business District & Economic Development Incentives

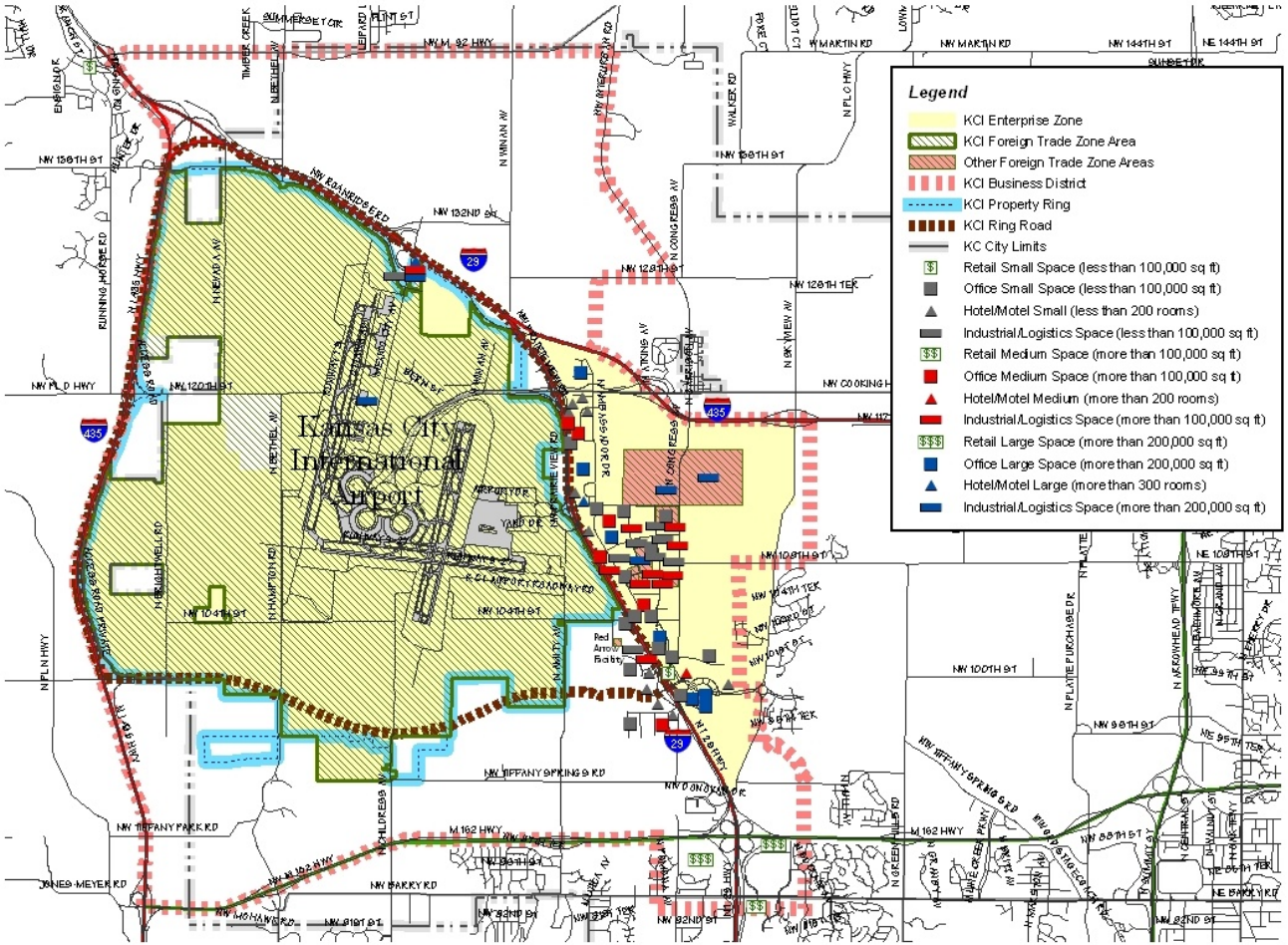


Exhibit 1.39. KCI Airport Property and Surrounding Area with Proposed Clusters

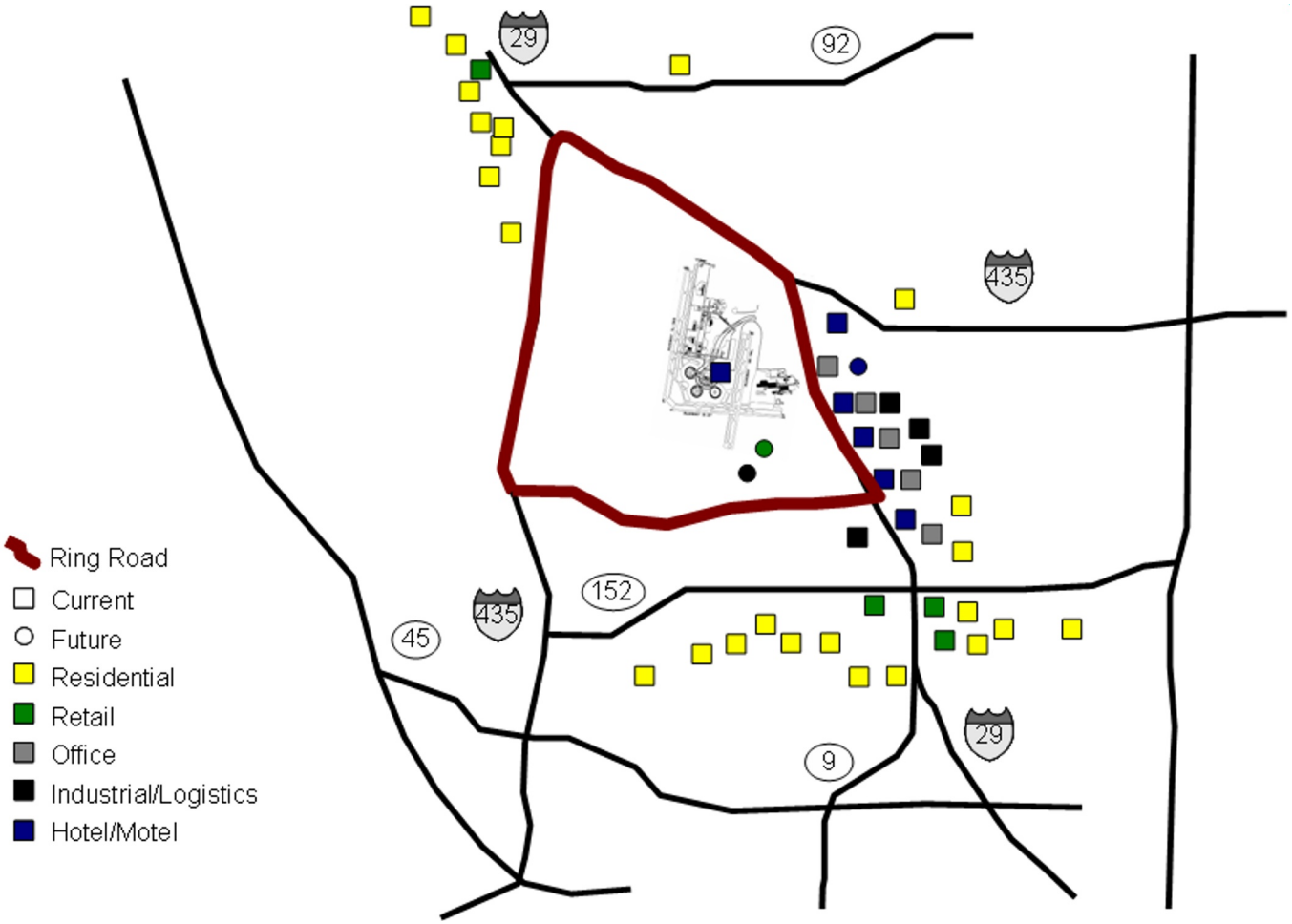


Exhibit 1.40. KCI Intermodal Business Center

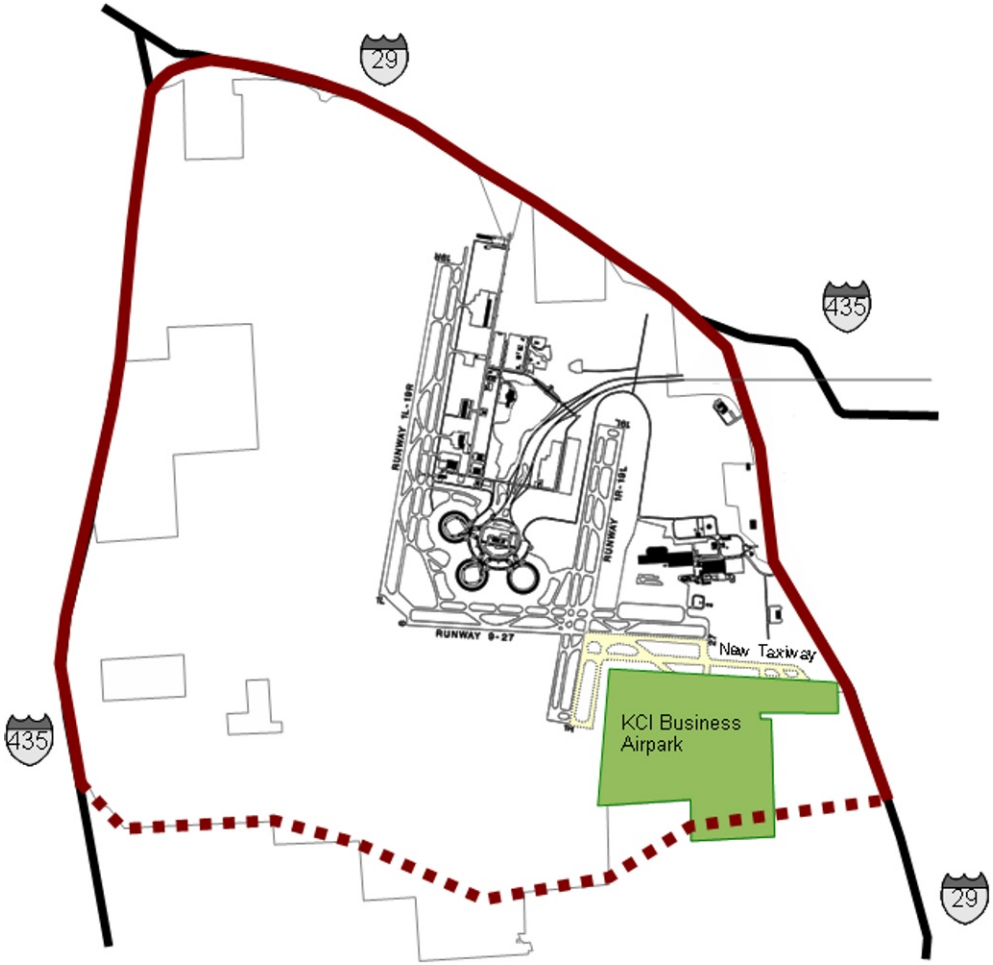


Exhibit 1.41. Location of KCI Business Airpark Conceptual Master Plan

Exhibit 1.42. Hong Kong International Airport

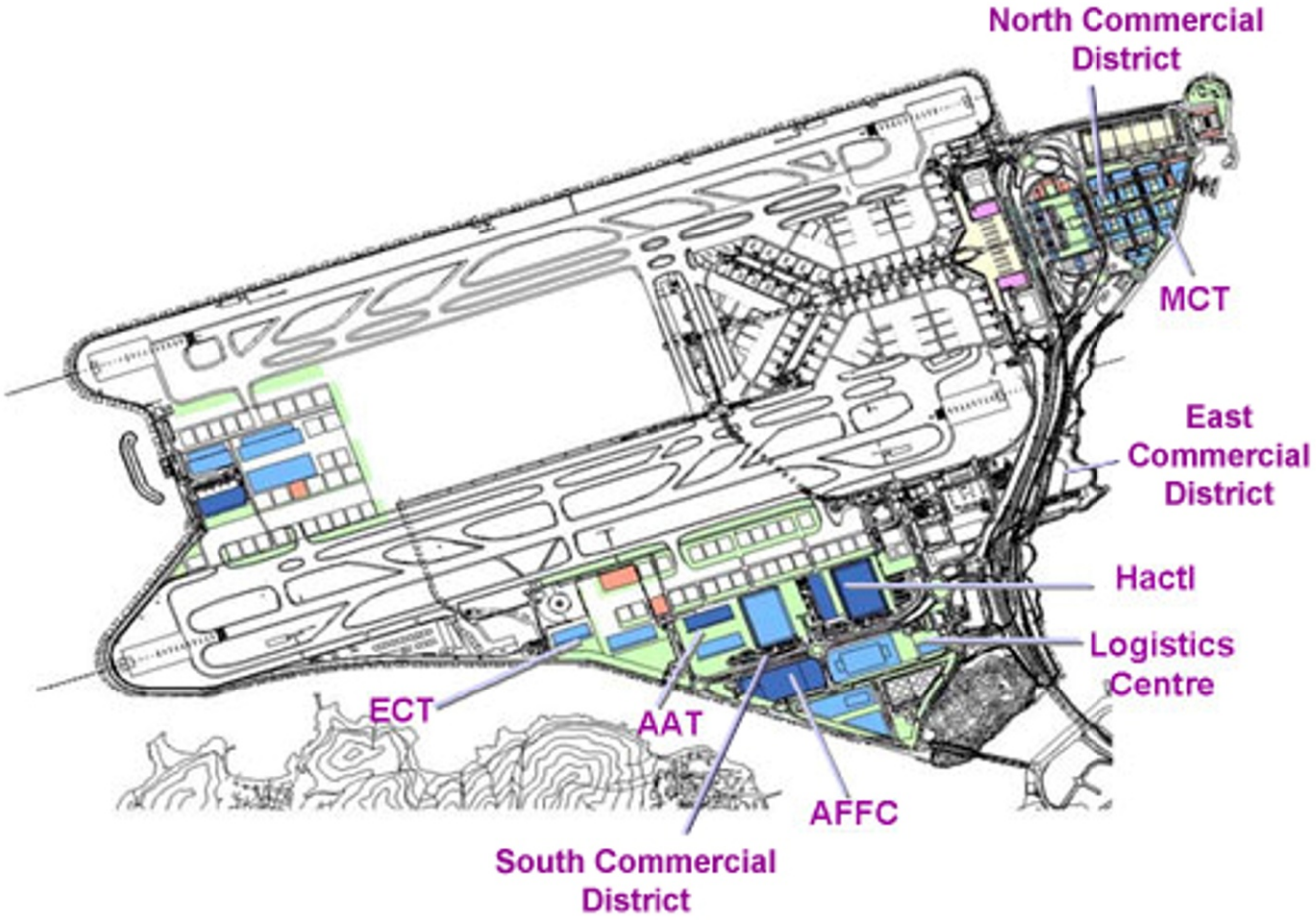


Exhibit 1.43. Office and Residential Development Near Hong Kong International Airport Major Cargo Terminal

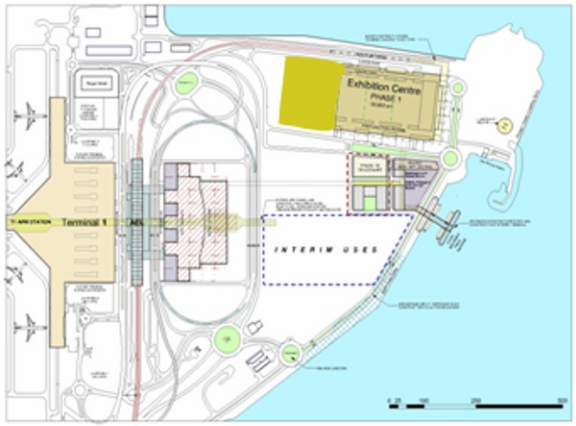
Exhibit 1.44. HKIA SkyCity, Phase I

Source: SOM.

Exhibit 1.45. Terminal 2 / SkyPlaza

Source: SOM.

Exhibit 1.46. SkyCity — Phase 1



Phase 1

International Exhibition Center

SkyPlaza

Cross Boundary Ferry Terminal

Source: HKIA

Exhibit 1.47. SkyCity Ultimate Development Phasing Concept

Source: SOM.

Exhibit 1.48. SkyCity as a Pedestrian Precinct

Source: SOM.

Exhibit 1.49. SkyCity and Hong Kong Disneyland

Exhibit 1.50 SkyCity Economic Zone

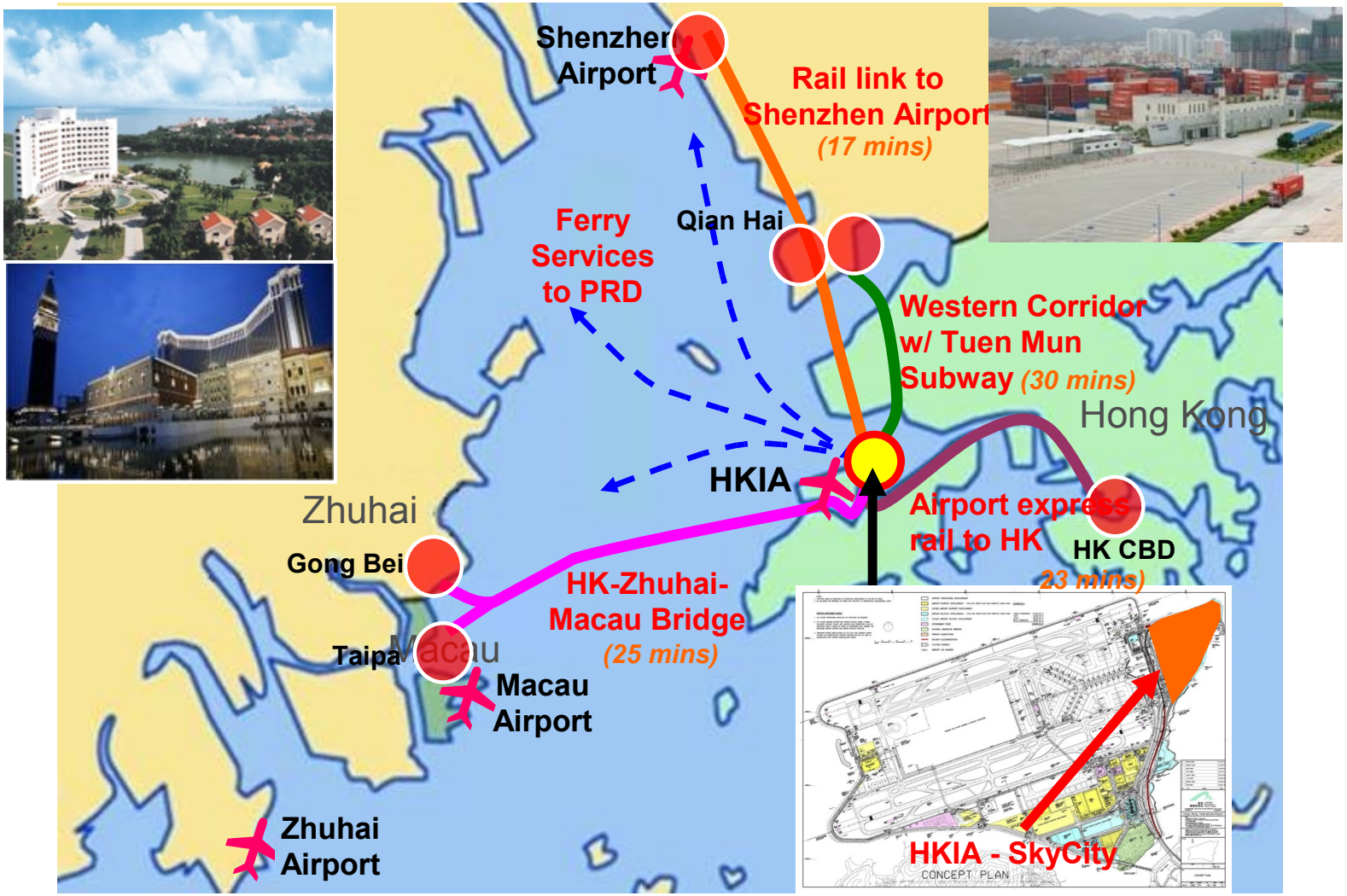


Exhibit 1.51. Incheon Airport Area Development Plan

Division	Area (ha)	Ratio (%)
Total	1,889.9	100.0
International Business	29.0	1.5
Industrial	60.7	3.2
Logistics	95.5	5.1
Commercial	23.1	1.2
Tourism	86.2	4.6
Residential	487.0	25.8
Public	1,108.4	58.6

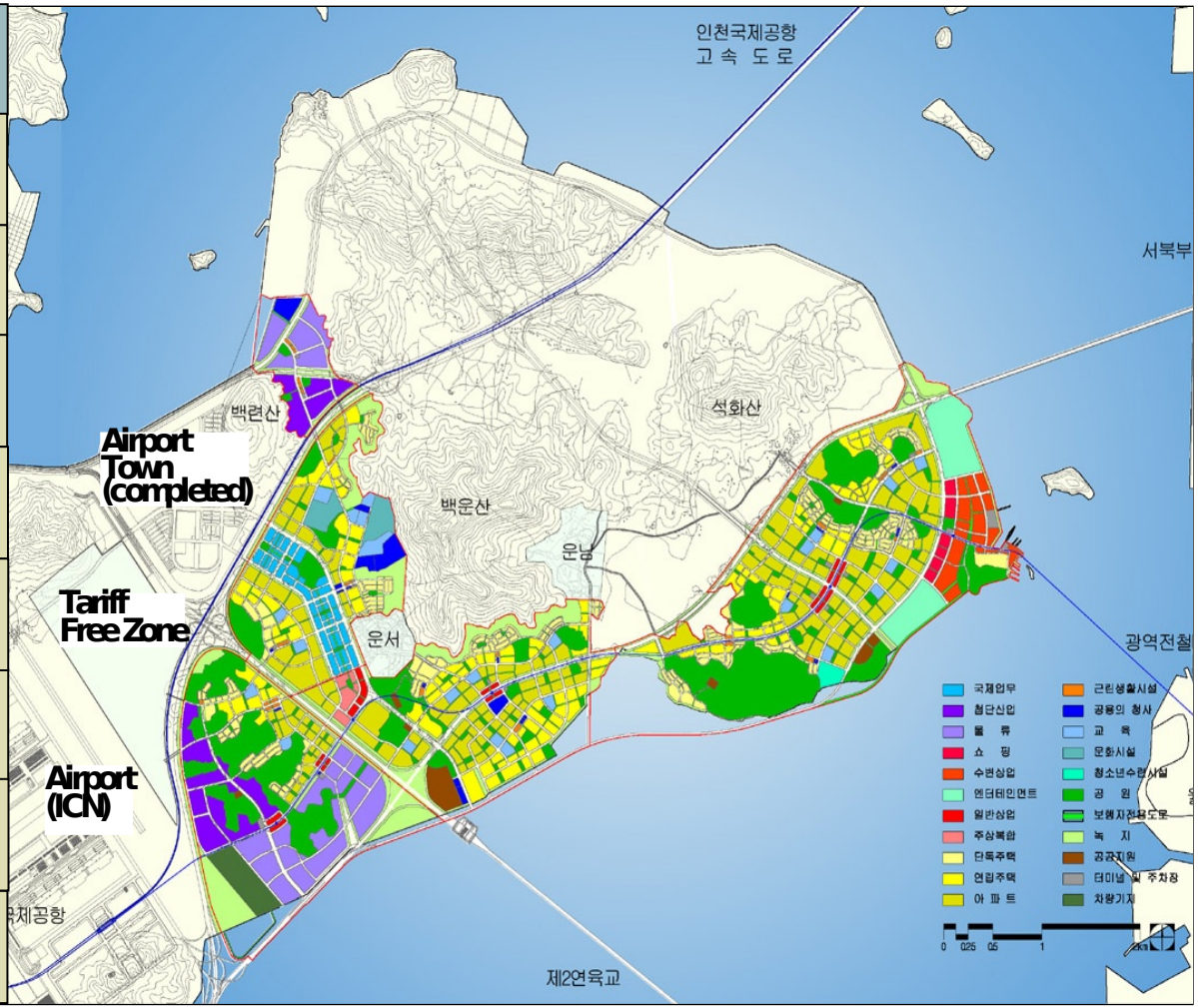
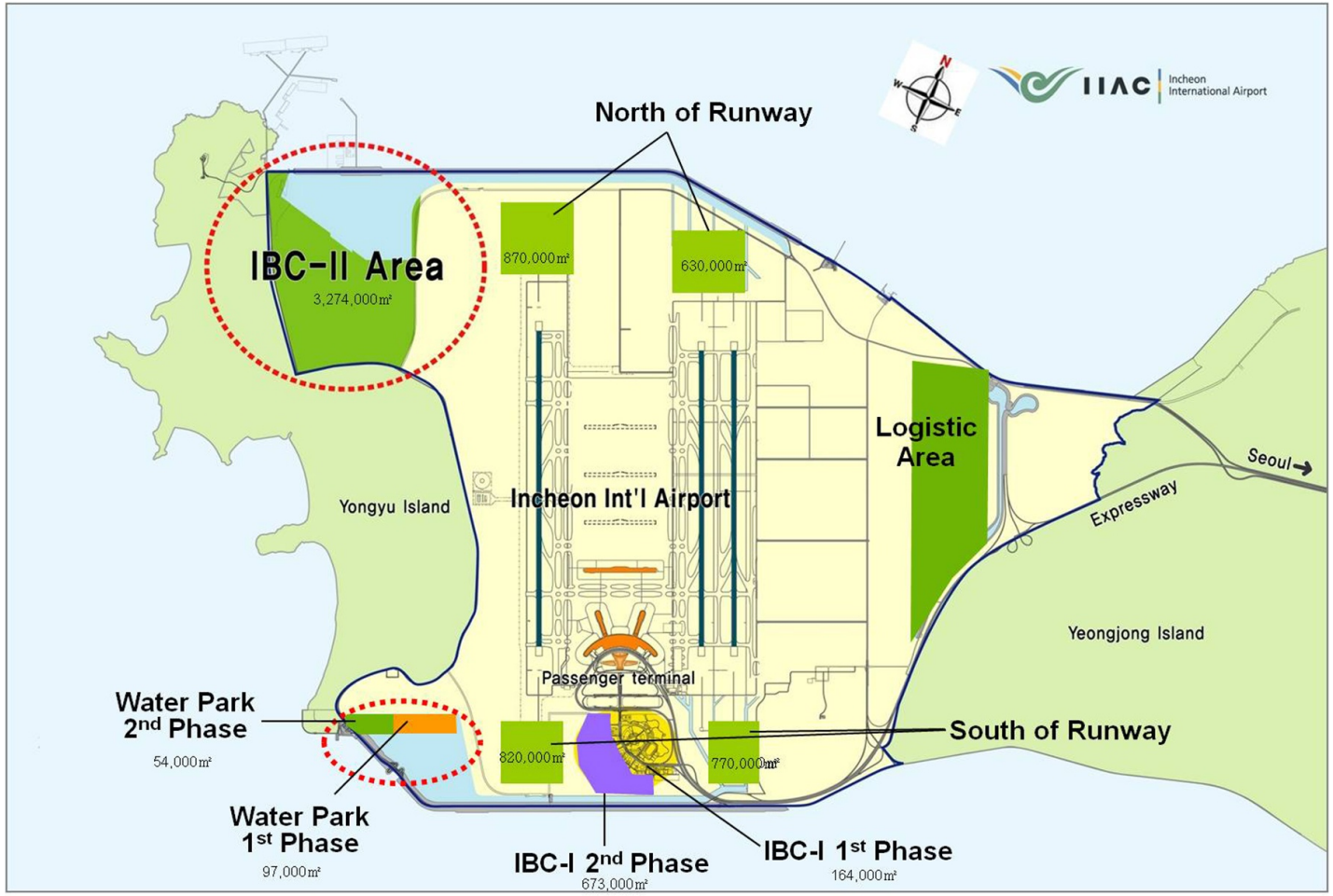


Exhibit 1.52. IIAC Air City Development Concept

Source: IIAC

Exhibit 1.53 Incheon International Airport (ICN) Land Use



Source: IIAC

Exhibit 1.54. New Songdo, Airport Edge City Near Incheon International Airport (Conceptual Plan)

Exhibit 1.55. Taiwan Taoyuan International Airport (TTIA)

Exhibit 1.56. Current Terminal 1 and Terminal 2 at TTIA

Exhibit 1.57. Taoyuan Aerotropolis Farglory FTZ Complex

Exhibit 1.58. Taoyuan Aerotropolis Functional Zones

Zoning		Area (hectares)
Airport Park	Airport Special Zone	1,780
	Free Trade Zone	215
	Total	1,995
Related Industries of Free Trade Zone		155
Aviation Industry Zone		670
Trade Exhibition Area		490
Airport-compatible Industrial Area		1,345
Coastal Recreational Area		360
Refined Agriculture Development Area		460
Quality Living Area		685
Total		6,160

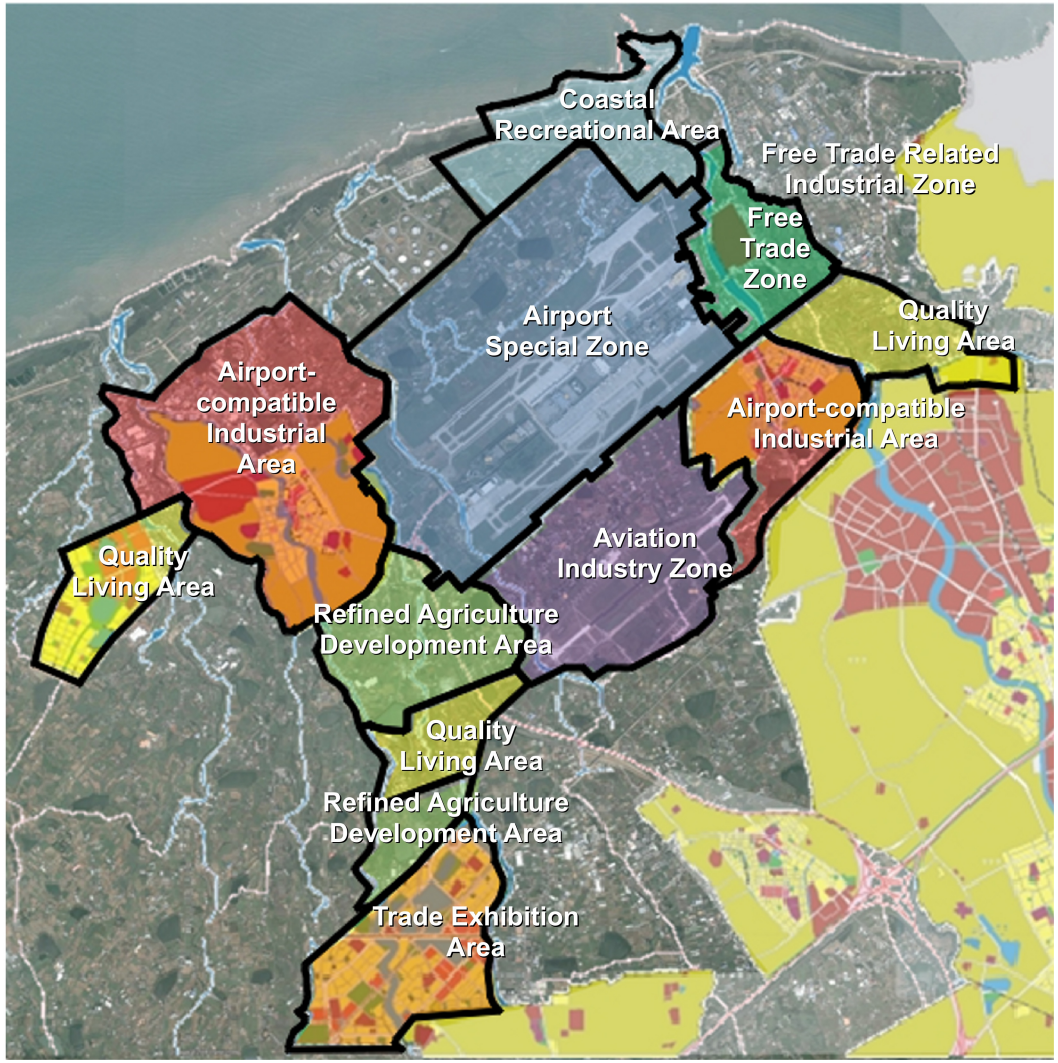
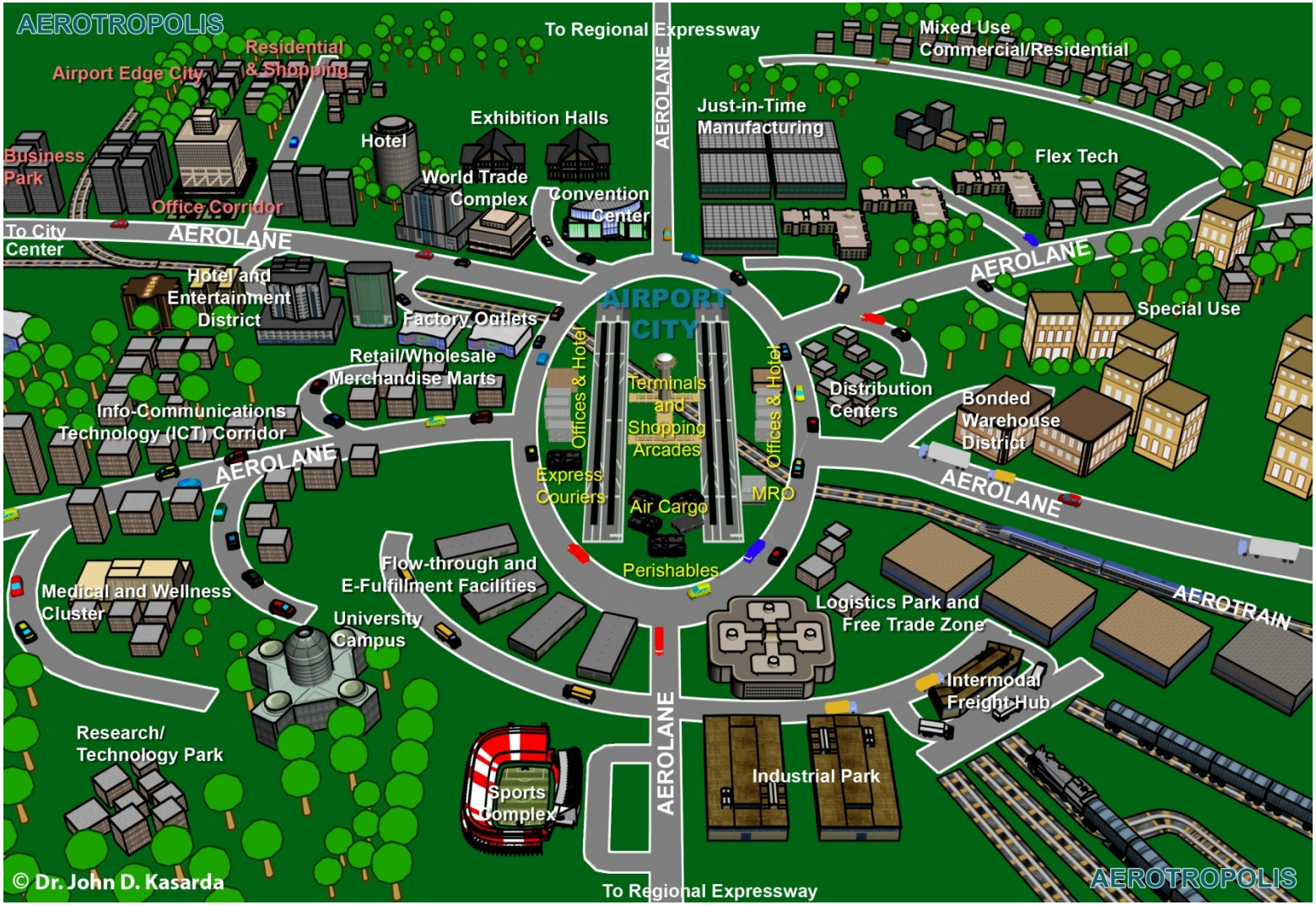


Exhibit 1.59. Dubai World Central International Airport and Its Adjacent Airport Cities

Exhibit 1.60. Airport City and Aerotropolis Commercial Elements Overview

	People-oriented	Goods-oriented
Terminal	• Retail (including upscale boutiques) • Restaurants (higher-end and themed as well as fast food) • Leisure (spas, fitness, recreation, cinemas, etc...) • Culture (museums, regional art, musicians, chapels)	
Terminal area	• Hotels and entertainment • Office & retail complexes	• Logistics and Air Cargo
Elsewhere on airport or outside the fence	• Convention & exhibition centers • Business and technology parks • Retail centers and wholesale merchandise marts • Information and communications technology complexes • Bioscience and medical facilities • Higher education campuses • Large mixed-use residential developments	• Free trade zones & customs free zones • Logistics parks and distribution centers • Industrial estates and light manufacturing • Time-sensitive goods processing

Exhibit 1.61. Basic Airport City & Aerotropolis Schematic



Chapter 2

Infrastructure and Facility Plan Guidelines

2.1 Introduction

The previous chapter outlined the reasons for the centrality of fast-cycle logistics and air transport in today's methods of doing business, as well as in contemporary leisure travel. The declining real cost of air transport, the increasing value-to-weight ratio of goods, the growing dispersion of integrated supply chains, and the need for their speedy connectivity underlie the rise of fast-cycle logistics. Similar factors account for the growth in business air travel while the growth of real incomes helps fuel tourism and leisure air travel.

Despite periodic downturns, volumes of air shipments and passenger travel are expected to continue to expand at a healthy pace over the coming decades. This will have far-reaching implications for immediate airport-area land use, Ekurhuleni and Gauteng development patterns, and supporting inter-modal ground access.

The increasing volumes of air cargo and passenger traffic are supporting a widening set of aviation-linked commercial activities on, around, and outward from airports. These activities typically originate inside the airport fence but increasingly spill over into the nearby areas and outward along connecting

airport highways. As described in the previous chapter, such functions include, but are not limited to, office buildings, hotels, exhibition, conference, entertainment and tourist attractions, medical and wellness facilities, logistics, distribution, and time-sensitive goods processing.

In terms of land-use, thus, just as central business districts and train stations once developed in a symbiotic relationship to drive urban development, new airport cities are emerging on and around many airports to serve the needs of shippers and travelers and to provide convenient sites for air-dependent businesses. This is not always a smooth process, however, with barriers often in the way. One significant barrier in Ekurhuleni is the dampening effect of obsolete, lower-value manufacturing and warehouse facilities near the airport and limited open space, pushing much aerotropolis development beyond the city.

Apropos the above, the Ekurhuleni Regional Spatial Development Framework (2012) states that there is only a total of 2,000 hectares of land that could be developed for industrial facilities and some 1,600 hectares will be for commercial use. The bulk of the industrial development will be infilling and extending industrial areas in the Isando/Spartan/Jet Park complex, Wadeville and Alrode. The report further states that the only area of new development significance is along the R21 corridor mainly east of the freeway where about 130

hectares of new light industrial and 400 hectares of commercial facilities could be developed by 2025.

Here is where surface transport infrastructure and intermodal facilities play a prominent role. Building on the economies of sharing inter-modal infrastructure that are enhanced by the operational advantages of major hub-and-spoke air service like ORTIA provides, development emanates outward, spreading economic growth throughout a broader airport-dependent (aerotropolis) region. This development creates spines and clusters of commercial facilities as firms make location decisions by balancing proximity to air access with land and labor costs and other location-specific advantages (or disadvantages such as congestion and crime) according to their own particular needs. Thus, where air accessibility remains a major business need, but where airport area land constraints exist, even some air dependent manufacturing plants might locate up to an hour's drive from the airport, curtailing benefits to the immediate airport area. This has been observed, in fact, with the shift of some aviation-oriented manufacturing from Ekurhuleni to Tshwane and beyond.

Nevertheless, with or without planning, aerotropolises and their airport city cores will continue to form and grow because of the increasing use of air transport for business and leisure activities. The real question for the Ekurhuleni Aerotropolis is, will it form and grow intelligently, in an organized and attractive manner, generating mutual benefits for the airport, the EMM, and the

broader Gauteng Province? Or will such development occur as it has around so many large airports—spontaneoulsy, haphazardly, inefficiently, and often unsightly with a mixture of obsolete and new structures—not significantly upgrading Ekurhuleni's image while detracting from economically efficient and sustainable growth?

To illustrate, some older, once showcase, airports are now strained with negative consequences for the cities and region they serve. When they were built, airports such as JFK, LAX, and Heathrow, the gateways to New York, Los Angeles, and London, respectively, were considered models of good airport planning. Today, each is overwhelmed. JFK, for instance, one of the largest international cargo and passenger airports in the world, has only a single truck access route, which is frequently clogged, and it lacks cost-effective, rapid passenger access to Manhattan. The result is reduced metropolitan region competitiveness despite a very favorable sectoral mix and excellent national and international air connectivity.

Though significant strides have been made in improving highway and passenger connectivity to ORTIA, Ekurhuleni and Gauteng Province certainly need improved infrastructure and intermodal facility planning to allow ORTIA to grow efficiently and for the municipality and province to fully capitalize on that growth. Otherwise the goose that could be laying future golden eggs for the Ekurhuleni and Gauteng might get strangled.

In the sections that follow, I will provide the strategic guidelines to avoid this problem and contribute to a vibrant and growing Ekurhuleni Aerotropolis. These strategic guidelines will focus on two critical elements: (1) transportation infrastructure and related intermodal facilities, and (2) airport area commercial land use and related business facilities.

My central message will be this. In order to maximize the golden eggs ORTIA can generate for the Ekurhuleni and Gauteng economies, future airport planning must be better integrated with future urban (Ekurhuleni) and provincial (Gauteng) planning in proposing the transportation infrastructure and commercial land uses required to support (1) air transport services, (2) travelers, and (3) the municipality's and province's businesses which depend upon ORTIA. This, in turn, will require far more extensive coordinated planning between ORTIA and Ekurhuleni and between both and Gauteng Province.

Such integrated airport, urban, and regional planning (the foundation of effective Aerotropolis master planning) needs to be rooted in a dispassionate, critical assessment of the airport's, municipality's, and province's strengths and weaknesses and the imminent external opportunities and threats. The plan needs to address the weaknesses identified and build on strengths found in order to ameliorate threats and take advantage of opportunities.

In this regard, ORTIA, Ekurhuleni, and Gauteng Province are surely not starting from scratch. Major components of the critical assessment and

transportation and land-use plans have been completed by the airport, the city, and the province, most in an in-depth manner. These include, among others:

1. ORTIA Master Coordinated Plan
2. The Rhodesfield Market Study
3. Rhodesfield Urban Design Framework
4. Ekurhuleni Integrated Transport Plan
5. Ekurhuleni Corridor Development Study
6. Ekurhuleni Metropolitan Spatial Development Framework
7. Regional Spatial Development Framework for Region A
8. Gauteng Provincial Development Framework
9. Gauteng Spatial Development Framework
10. Gauteng Province Freight Transportation Implementation Strategy: Intervention Plan

These plans and studies provide a great amount of detail on transportation infrastructure and land-use for ORTIA, Ekurhuleni, and the Gauteng Province, as well as describing opportunities and constraints for each. Instead of discussing them, I will highlight their most pertinent elements for Ekurhuleni Aerotropolis development. This will allow me to direct the vast majority of my attention to strategic issues that will complement rather than repeat the tactical issues and local details so extensively treated in existing reports.

My objective in this regard is twofold: (1) create a strategic roadmap for these and future reports to follow if many of their recommendations are to be

implemented and (2) present the planning guidelines and critical success factors upon which an integrated Ekurhuleni Aerotropolis Master Plan can be developed.

2.1.1 Chapter Outline

I will commence by highlighting key transportation infrastructure and intermodal facilities as they impinge on Ekurhuleni Aerotropolis development, noting challenges that need to be addressed. I will then move to pertinent commercial land-use issues focusing on ORTIA and Ekurhuleni, but commenting on those at the provincial level, where appropriate.

Following my baseline treatments of transportation infrastructure and commercial land-use, I will describe what is needed in terms of infrastructure configuration and intermodal facilities design to create a fast-cycle air logistics complex at and around ORTIA to catalyze business competitiveness and attract new investment throughout the Ekurhuleni Aerotropolis and beyond. Here, I will present guidelines for ORTIA's new midfield cargo facility and industrial development zone including intermodal interfaces, on-site transportation infrastructure for connectivity, electronic data interchange and IT system guidelines, and designs for future tenant and business user needs. The chapter concludes specifying functional capabilities required for an ORTIA air logistics

hub to drive commercial development outward from the airport as well as critical success factors for all future planning to incorporate.

2.2 The Aerotropolis Engine: ORTIA

OR Tambo International Airport (ORTIA), the busiest airport on the African continent and second busiest (next to Dubai International) in the entire Africa/Middle East region, is the heart that will be pumping new economic blood into the Ekurhuleni Aerotropolis and the greater Gauteng Province. Owned and operated by the Airports Company of South Africa (ACSA), ORTIA is the hub for South African Airways (SAA), low-cost carrier Mango, and other smaller domestic airlines. Most of the world's leading international airlines serve the airport.

At present, 49 commercial airlines serve 18 local destinations, 28 regional destinations, and 49 international destinations (see Exhibit 2.1). Together, they handled 18,643,145 passengers in 2010 –11, including 7,965,594 international passengers. This represents a 6.4% increase over 2009–10 in international passengers and 5% increase in domestic passengers.

ORTIA is also served by 14 airlines providing air freighter service. Many of these, such as Atlas Air, Cargolux, Emirates Skycargo, FedEx, KLM Cargo, Lufthansa Cargo and Singapore Airlines Cargo are among the largest cargo

carriers in the world. Combined cargo carried by passenger and cargo airlines serving ORTIA exceeded 300,000 metric tons in 2010 –2011, with approximately 80% carried in the bellies of passenger aircraft. It has been estimated that more than 90% of the international freight in and out of South Africa is handled by ORTIA.

Covering approximately 1,700 hectares, ORTIA is a relatively large airport by international standards, but not of the scale of some described in Chapter I. Its runways, with one (03L/21R) at 4, 400m (14,000ft), are of the longest in the world. The second runway is 3,400m (11,155ft) long. The siting of a third runway and potentially a fourth one to be built in the future is still being assessed.

With the opening of the new Central Terminal Building (CTB) at a cost of R2 billion, ORTIA possesses one of the finest passenger facilities in the world. This state-of-the-art terminal provides an indoor link between the domestic and international terminals, the latter which has been expanded and modernized to increase its capacity and serve the Airbus A-380 Superjumbo. Along with the upgrading of the domestic terminal, the new Central Terminal Building offers additional gates to increase passenger capacity, a point I will return to shortly.

The airport's 50,000 m² cargo facility handles a variety of high-tech and perishable items ranging from mobile phones and aircraft engines to fresh cut flowers and fruits. SAA Cargo is the facility's largest client.

In addition to expanded parking and commercial facilities which will also be addressed later, there is a large technical facility in the western precinct. This facility appeared to me to be underutilized and potentially in the way for direct access to newer developing Ekurhuleni commercial areas. Some thought might be given to its relocation when the future eastern MRO precinct opens.

A key objective of ACSA is increasing the capacity at ORTIA's passenger and cargo facilities to meet future demand and better serve the region and nation. Current capacity of the existing passenger facilities has been estimated to be between 25 and 28 million and current cargo capacity at approximately 325,000 tons.

A new midfield passenger terminal in the southern sector of the airport is planned as well a new midfield cargo village in the northern sector. Together with the proposed third (and possibly fourth) runway, passenger capacity can be increased to 66 million annually and cargo capacity to over 1 million metric tons annually.

It has been suggested that given constraints and challenges posed by the airfield and area surrounding ORTIA that planning commence immediately to look for a second international airport site to serve the province, possibly near Sandton. I believe this would be a costly and counterproductive mistake. Aside from the environmental impact issues that would need to be fully addressed for a second major commercial airport site and huge capital expenditures, ORTIA

infrastructure already in place and being improved would not be fully capitalize upon.

The second international airport would also likely be resisted by airlines who depend extensively on inter-line transfers. Moreover, duplications of airline facilities would add to costs and actually split the province's air travel market meaning that fewer international routes could be supported with two airports rather than a single airport.

Many businesses that have selected sites for quick access to ORTIA may not have similar access to the new airport location. The Ekurhuleni Aerotropolis would be negatively affected overall since its primary engine (ORTIA) would not be as strong under a dual commercial airport scheme, with a second airport site likely some distance from its business core.

Our studies at UNC's Kenan Institute are showing that only when capacity can no longer be expanded at an existing gateway airport does it make economic or practical sense to open a second airport. In this regard, experiences in Bangkok with businesses around its older Don Mueang International Airport when the new Suvarnabhumi International Airport opened is telling. High-tech firms that had been locating on the northern side of the city to take advantage of their access to Don Mueang were placed at a serious competitive disadvantage when Suvarnabhumi opened on the other side of Bangkok, adding up to 45 minutes more trucking time to access their international suppliers and customers

who utilized air cargo. Many closed or left the country rather than build new manufacturing facilities near Suvarnabhumi.

Two strategic questions arise for ORTIA. First, what will be the actual passenger and cargo capacity at ORTIA when the new runways and new midfield terminals are completed? Second, how can intermodal surface connectivity be improved so the capacity limits for both passengers and cargo can be efficiently expanded?

2.2.1 NextGen and Intermodal Impacts on Capacity

Assuming that sufficient terminal capacity can be provided, airport capacity will be largely limited airside by runway and taxiway constraints and landside by connecting surface infrastructure constraints.

Commencing airside, it is possible that with just three runways and supporting aeronautical infrastructure, ORTIA will be able to meet capacity needs for at least the next three decades and possibly indefinitely. Technological advances are about to be introduced that will likely have a revolutionary impact on efficiency of aircraft movements and runway capacities.

Let me elaborate by first noting a caveat about forecasting future runway demands. The basic challenge is that there is no set formula based on aircraft operations (movements) or passenger/cargo volumes that can be applied across

airports in general to determine when runway capacity (the need for a new runway) will be reached. Every airport is different and therefore has a different set of factors that affect runway capacity. Conditioning factors include size and type of aircraft the airport serves; spatial separation of runways; weather conditions; whether or not the airport is primarily a hub where banks of aircraft peak a number of times a day; surrounding communities and related noise issues; taxiways, aprons, and other aeronautical infrastructure; air capacity constraints over a metropolitan region, and factors shaped by the air traffic control (ATC) system in use.

The last factor, the ATC system, is not only a moving target but is set for major improvements world-wide that will substantially increase airport runway capacities in the not-too-distant future. These increasing capacities will be created under the rubric of what is known as The Next Generation of Air Traffic Control Systems (NextGen for short).

NextGen moves from today's ground based radar and human dependent ATC systems to one based on satellite navigation and control with digitized non-voice (i.e., non-human) communication. Recently completed testing of this system in the United States has shown that it is much safer as well as far more efficient in controlling aircraft both in the air and on the ground. It safely reduces time and geographic separation of aircraft in takeoffs and landings (in-trail separation), improves the management of wake turbulence, and dramatically

reduces the spatial separation needed on parallel runways to allow simultaneous takeoffs and landings, even in bad weather since Next Gen maintains VFR-like runway capacity during inclement weather.

Following tests at a large number of U.S. major airports, the U.S. Federal Aviation Administration (FAA) has estimated that by 2018 (at which date NextGen I is expected to be widely introduced) that each runway will be able to add an average of 21 flights per hour during peak periods and that in-flight and ground delays will be reduced by 35%. Although no precise figures on runway capacity increases and reduced air and ground delays have been provided by the FAA on NextGen II, which is anticipated to be introduced by 2025, the FAA states that these will be "substantially beyond that of NextGen I."

The point I wish to reiterate is that the aviation industry is on the cusp of introducing a major technological advance that will revolutionize ground and air traffic control and the way aircraft operate in the near future. The outcome will be a huge boost in airport runway capacity that will likely reduce future ORTIA additional runway needs. Three runways may well do, but four should certainly be sufficient into the indefinite future with NextGen II.

In making this assessment, I also looked at a number of other larger, growing airports around the world to provide some rough benchmarks. One is Hong Kong International Airport which currently handles 50 million passengers annually, 4.1 million tons of cargo, and 316,000 flight movements annually with

two parallel runways. To meet forecasted growth to 97 million annual passengers, 8.9 million tons of cargo and 600,000 air traffic movements annually by 2030, the Airport Authority of Hong Kong has decided to build a third runway. The average size of aircraft serving HKIA is larger than those serving ORTIA so issues such as aircraft separation and wake turbulence negatively affect its runway capacity.

Other major hub airports in Asia with high volumes of passengers and cargo and high peak aircraft movements operate with either two or three runways such as Beijing Capital Airport (3), Shanghai Pudong (3), Seoul Incheon (3) and Bangkok Suvarnabhumi (2). London Heathrow processes 64 million passengers annually with two runways and Gatwick over 35 million with one runway. Not that we are not seeing serious runway capacity problems at these European airports, but before efforts be made to consider a second major commercial airport for Gauteng Province, recognition must be made of NextGen providing substantially more aeronautical infrastructure capacity at ORTIA than current estimates.

The primary airport capacity constraint, in my opinion, and that of other knowledgeable planners with whom I have discussed this issue, will likely be maintaining uncongested ground access to ORTIA's terminals. As will be discussed in the next section, the Gautrain which links ORTIA to Sandton and beyond could be extended directly to the new midfield passenger terminal.

Improvements to be discussed in municipal rail line access would further help as would reconstructing the spaghetti intersection of R21 with R24 opposite the western precinct and the establishment of a ring road around ORTIA. Other airport ground access improvements will be noted later.

2.2.2 ORTIA's Conservative Current Economic Impact

Before addressing surface infrastructure issues, let me comment on ORTIA's economic impact. A 2011 report by consulting firm Oxford Economics explained the contribution of aviation to South Africa's economy[3]. Based on an analysis of 2009 data (which was a major down year in aviation due to the global recession), they found that the aviation sector in South Africa contributed R50.9 billion to the nation's GDP, 443,000 jobs directly and indirectly (including aviation catalyzed tourism jobs) and R6 billion in taxes directly and another R7.3 billion in tax revenue indirectly.

These are conservative estimates because, as the report notes, they do not include such features as productivity enhancements that aviation provides by permitting South Africa's firms to quickly access their global suppliers to obtain the highest quality production inputs at the lowest cost. Nor do they include the catalytic effects created by firms that set up their African headquarters in

[3] Oxford Economics. Economic Benefits from Air Transport in South Africa. Oxford, England. 2011

Gauteng Province or other business service facilities because of the speedy connectivity ORTIA provides their executives to enterprise partners of clients in other markets in Africa and beyond.

ORTIA handles 53% of all air passenger trips in South Africa. However, the hub handles a much greater variety of national and international routes and can thus offer Ekurhuleni and Gauteng businesses far more access to national and international markets than this airport passenger percentage would indicate.

Nevertheless, taking 53% as the proportional contribution of ORTIA of South Africa's aviation contribution to the GDP, jobs and taxes yields the following annual economic impact of ORTIA:

Contribution to GDP	R27 billion
Contribution to employment	234,790 jobs
Contribution to taxes	R7 billion

As noted, these are quite conservative estimates because the figures reported do not capture the full economic benefits generated by South Africa's aviation, in general, and ORTIA's in particular. Once ORTIA's future airport city and the surrounding Ekurhuleni Aerotropolis are developed, ORTIA's economic impact will mushroom.

2.3 Highways

Improved surface transportation connectivity is not only important to expanding airport capacity. It is also key to fast-cycle logistics and aerotropolis development.

I noted previously that the battle for air cargo is often won on the ground. In our new time-competitive economy, it is total travel time (ground and air) that is critical for transporting both products and business people, not just flight time. The Aerotropolis is a new multimodal model that gives at least as much attention to the time and cost of connecting the airport to its key industrial, business, and residential nodes as to the speedy connectivity the airport provides to distant markets.

As detailed in the Regional Spatial Development Framework for Region A (draft Feb. 2012), the Gauteng Province and Ekurhuleni have an excellent road network overall that has been significantly upgraded during the past decade. Ekurhuleni, in particular, has well-maintained, modern expressways that link it to the region and the nation. With major highways N3, N12, N17, R21 and R24 converging at or relatively near ORTIA, such as the Gillooly Interchange, Ekurhuleni is a roadway nexus for the province and the nation (see Exhibit 2.2)

Considerable commercial, industrial, logistics, and distribution development has taken place along these corridors and near their interchanges.

For instance, just five minutes from ORTIA is the Albertina Sisulu corridor straddling the R21 Freeway which has evolved into a prime investment and development location. N3 is the major trucking route to the eastern portion of the country and to Durban Port while N12 and N17 are major freight routes to Mpumalanga. N3 is also evolving into a modern logistics corridor, especially as one approaches the airport, with such leading freight forwarders as Kuehne + Nagel locating their facilities. N3 is experiencing significant office and hotel development, as well, within 10 to 15 minutes of ORTIA.

Not all this corridor development nicely fits the Aerotropolis strategy. The R24 corridor, for instance, linking ORTIA to Johannesburg has developed in an ad hoc manner over the years to include clusters of airport-oriented activity interspersed with less efficient and inappropriate uses. An explicit corridor development plan should thus be an important component of an Ekurhuleni Aerotropolis master plan.

In terms of the main Ekurhuleni Aerotropolis corridors, N3, N12, R21, and R24 will likely be the most prominent. However, because of land-use constraints near ORTIA, most commercial development is stretching out beyond the metropolitan municipality. New policies and strategies are called for to free up developable land and create a more attractive commercial environment near the airport to draw more of these investments closer to the center of the Ekurhuleni Aerotropolis.

For example, the spaghetti intersection of R21 and R24 opposite the western precinct sterilizes large tracts of developable land and cuts off the western and northern precincts from Rhodesfield. Rerouting the R21 to the west of Rhodesfield (along the railway reserve) between Voortrekker Road and R24 would facilitate improved linkages between Rhodesfield and free up valuable land for development adjacent to the western precinct and the cargo handling precinct to its north.

In addition to to reworking the R21/R24 interchange, new roads (PWV14, PWV15, PWV16, K86, K88) have been recommended by the EMM Integrated Transportation Plan as well as High Occupancy Vehicle lanes at more congested portions. Dedicated truck lanes to cargo complexes might also be considered in future highway plans. The realignment of K90 to link directly with new cargo precinct would likewise be desirable as will be completing the airport ring road for ready access to all significant commercial areas planned at and around ORTIA (to be discussed in a later section of this chapter).

Airport area bus stations and their related intermodal access (including rail) to the airport for air passengers and ORTIA's nearly 18,000 employees need to be better rationalized. Current pedestrian connectivity between PRASA's Isando and Rhodesfield (Kempton Park) stations and ORTIA is poor so connecting shuttle bus service would help. Addressing the growth of automobile

traffic and truck congestion on secondary roads near the airport is necessary, too, to facilitate movement.

Further out, R21 should be upgraded and realigned at the northern end to better connect the Ekurhuleni Aerotropolis with Tshwane and the eastern part of Johannesburg. Such upgrading in the near term will become even more important for the future to accommodate forecasted significant increases in truck freight movements on R21 as well as to improve highway connectivity between ORTIA and both Sandton and Tshwane.

Let me also note that growing congestion on N1, N3, and N21 will negatively impact fast-cycle logistics as a competitive advantage of the Ekurhuleni Aerotropolis. So too will heavy truck movements on other routes such as the Ben Schoeman Highway.

The Ekurhuleni ITP and February 2012 draft Regional Spatial Development Framework for Region A discuss Ekurhuleni highway choke points and needed upgrades in considerable detail. Readers are referred to these solid assessments. Suffice it to note here that approximately 40% of all automobiles and trucks registered in South Africa are registered in Gauteng Province. Many of these travel routinely to and from ORTIA or through Ekurhuleni. Moreover, a large number of trucks and automobiles not registered in in the province regularly transit on ORTIA's connecting highways corridors and use Ekurhuleni's secondary roads. Any Aerotropolis strategy must,

therefore, be cognizant of and limit the potential dampening effect roadway congestion will have on attracting and growing the very types of higher-value, time-critical businesses that are essential to Ekurhuleni Aerotropolis fast-cycle success.

2.4 Rail

As South Africa's industrial center, Ekurhuleni is served by numerous main rail lines with arterial lines radiating from them. A large proportion of the 8 main lines and secondary main lines operating in Gauteng Province (the rail hub of the nation) are located in the EMM. Most of these serve both passenger and freight, connecting the municipality with all major cities in southern Africa as well as ports (Durban, Richard's Bay, Port Elizabeth, Cape Town and Maputo).
Exhibit 2.3 illustrates the rail corridor which is discussed comprehensively and in detail in the Ekurhuleni ITP and Region A Spatial Development Framework. Highlights are presented below.

For product transfers, the EMM hosts 9 major goods rail yards, including the Sentrarand Intermodal Yard, owned by Transnet. This massive intermodal complex employs over 1,000 workers, covering 6,000 hectares with a capacity of 7,000 rail cars. Approximately 100 trains pass through this complex every day

with some days experiencing up to 150 trains. Sentrarand's largest amount of goods handled in one day exceeded 90,000 tons.

Slightly to the west of the EMM is the City Deep Terminal. This bonded inland depot is the largest container logistics hub in Africa and 5th largest in the world. Gauteng Province, through Blue IQ, has made improving road access to City Deep a priority in implementing road infrastructure improvements such as the Wadeville-Alrode Industrial Corridor to increase the efficiency and decrease the costs of moving containerized cargo to and from the terminal.

Given the historic heavy industry nature of its economic base, the Ekurhuleni ITP identified 25 industrial areas in the city which are served with over 700 rail sidings. The study found that less than 300 are serviceable, however, and far fewer used regularly. Such disuse reflects the functional change in the mix of Ekurhuleni's economy away from heavy industry that utilized rail spur sidings to containerized shipments and the increased use of trucking to move products.

This trend is structural and essentially impossible to reverse. Nor would it be productive for Ekurhuleni' emerging lighter manufacturing industries if it were reversed. Indeed, the fast-cycle logistics acronym JIT (just-in-time) increasingly means just-in-trucks. Such a reality takes us back to the immediate prior section which emphasized highway and roadway improvements in Ekurhuleni and the greater province as the most efficacious ways to move its

new economy products quickly and efficiently to local, national, and, via ORTIA, international markets.

This does not mean that an Ekurhuleni Aerotropolis strategy should neglect the contributions of freight rail nor seek to improve it. It has been my experience that the most successful Aerotropolises have made freight rail pivotal to their competitive strategy. First, for longer shipments, containerized rail can take trucks off the road, lowering highway congestion while reducing costs to shippers. Second, many industries use a combination of truck and rail shipping predicated on needs with some mainly dependent on rail shipping (e.g. the automobile industry). They may also use air for emergency shipments. Thus, having the combination of quality highway, rail, and aviation infrastructure in the Ekurhuleni Aerotropolis will provide industrial recruitment advantages that only a small percentage of its competitors posses.

Since an Aerotropolis strategy is also about moving people to, from, and throughout it quickly and efficiently, passenger rail is equally important. Gauteng and Ekurhuleni are blessed to have Gautrain which connects air travellers and commuters between ORTIA, Sandton, Tshwane, Johannesburg and points in-between. In addition to the four anchors stations, six other stations are linked along its 80 kilometer route. With its quick and reliable access to ORTIA from Johannesburg, Sandton, and Tshwane, the Gautrain represents and exemplary "Aerotrain" central to the Aerotropolis model.

Nonetheless, there are constraints that need to be addressed with the Gautrain in planning its expansion to better serve ORTIA, Ekurhuleni and the greater province. Directly connecting the Gautrain from its Rhodesfield station to ORTIA must be done if Rhodesfield is to develop as the new central business district of the Ekurhuleni Aerotropolis. Likewise, the Gautrain is not integrated with the metro line at either Rhodesfield or Park station, the latter the largest in South Africa in terms of passengers. This substantially reduces both efficiency and Ekurhuleni Aerotropolis connectivity.

The Gautrain's ORTIA station was also originally to have been under the Central Terminal Building (CTB) with dedicated space constructed in the CTB basement for this purpose. This underground station location would have facilitated a future onward extension eastward to the midfield passenger terminal precinct and beyond to the Denel precinct and further to Benoni and eastern Ekurhuleni, bolstering both ORTIA's Aerotropolis East and eastern Ekurhuleni (see Exhibit 2.4). The commercial importance of this will be highlighted in the next section.

Without realignment of the rail line, a further eastward expansion of the Gautrain to ORTIA's future midfield passenger terminal will necessitate trains to reverse direction at the airport's western precinct and loop around the western periphery of the airport. The difficulty of extending the Gautrain line eastwards, combined with the current lack of connectivity between Rhodesfield and ORTIA,

will be serious impediments to successful Ekurhuleni Aerotropolis development. It is therefore imperative that ACSA, Ekurhuleni, the Gauteng government and Bombela (the private-sector operator of Gautrain) cooperate to address these impediments.

Finally, I have been informed by local planners that a high-speed rail line between Gauteng and Durban is currently under investigation, along with a possible route extension northwards toward Polokwane. With a view towards substantially enhancing Ekurhuleni Aerotropolis surface connectivity, an ideal alignment of this rail link would be along the Germiston-Rhodesfield-Olifantsfontein corridor directly past OR Tambo since both passengers and freight would be transported by this high-speed rail line. Appropriate Ekurhuleni stations would be designed to optimize other transport interfaces.

2.5 Ekurhuleni Aerotropolis Commercial and Logistics Facilities

The Ekurhuleni Metropolitan Municipality is basically a fragmented amalgamation of 11 prior administrations. Since this urban conglomerate formed around mining belts, it has lacked a single organizing center driving development. Without this core diver, virtually all of its multiple relatively small CBDs scattered throughout the EMM have been in decline, as have most industrial areas surrounding them.

An Aerotropolis strategy based on ORTIA as the functional heart will provide Ekurhuleni with core economic driver spawning new commercial, logistics, and advanced industrial activities around ORTIA and outward. This section will describe the evolution of such a center commencing with commercial and logistics facilities planned for ORTIA and surrounding areas (the Aerotropolis core) and then systematically moving outward through the municipality and beyond into the greater Gauteng Province.

Focus will be on commercial opportunities showing the greatest growth potential following Aerotropolis principles. Included here will be upper-tier business services whose executive and professionals are aviation-intensive users, tourism and associated accommodation, entertainment, and retail; high-tech manufacturing, logistics, and other time-critical goods processing. These sectors tend to be higher-value generating and often higher-wage paying sectors then those which dominate Ekurhuleni's economy today.

Surprisingly, to some, these sectors also generate a considerable amount of employment for those without the education or skill sets to participate in these higher paying jobs. For example, the vast majority of those employed in the hotels near ORTIA work as maids, kitchen help, or in the hotel laundry. Taxi drivers and grounds keepers are supported as are table waiters in the hotels' restaurants. Office buildings likewise require grounds keepers and custodial

help, while logistics and goods processing firms employ numerous truck drivers and warehouse workers.

The bottom line is that Aerotropolis development creates at least as many jobs for the unskilled worker as for the highly skilled. It is equitable to all in the provision of opportunities. Let me now describe how Aerotropolis development will do this.

2.5.1 OR Tambo's Future Aerotropolis Development

A forward-looking commercial master plan titled ORTIA Aerotropolis was recently prepared for ACSA by a team composed of Osmond Lange Architects, ARUP and Ikemeleng Architects who collaborated with ACSA planners and executives in this master plan. The plan nicely meshes Aerotropolis development principles with ORTIA's proposed midfield passenger and cargo terminal to generate highest and best use commercial precincts on and near the airport that will be leveraged as well leverage the airport's current and future aeronautical infrastructure and facilities.

Exhibit 2.5 locates four commercial precinct that will be developed adjacent to ORTIA's airfield. Exhibits 2.6 and 2.7 provide greater detail and illustrative footprints of proposed structures.

The first will be an expansion of the western precinct (Airport City West) in front of the existing passenger terminals. This precinct will be transformed into a quality mixed-use commercial area that may also include some high density residential structures. Office building development is proposed above the multi-story parkade next to the new City Lodge with an adjoining "Piazza" (OR Tambo Square) that would include fine dining, upscale retail, conferencing and expo facilities, et cetera, forming the pedestrian-oriented central square of Airport City West. Accommodations will be provided by an adjacent hotel node consisting of the Intercontinental, City Lodge, and Southern Sun hotels. On the other (southern) side of the hotels will be a major office node planned for larger commercial office buildings targeted to air travel intensive businesses (such as regional corporate headquarters) and professional organizations where staff can quickly access ORTIA's flights or fly in their distant clients and enterprise partners for day meetings.

All these are good potential commercial uses. Let me reiterate, however, that without improving connecting road capacity in the western precinct, such substantial commercial development will be difficult to support.

Airport City South is planned to evolve with ORTIA's future midfield passenger terminal. An ambitious design contiguous to this terminal has been proposed with a 25 to 30 year horizon that will merge airport, urban, and business domains. Its grid-like complex of commercial facilities will be a mini-

city in its own right offering public realms of tree-lined walking streets, piazzas, and squares. Retail space will occupy the street levels of many commercial structures with some ground floor office space as well. A roadway roundabout will encircle the entire grid of streets, squares, and business structures which will provide easy access to all Airport City South buildings and commercial services.

Aerotropolis East has been made possible by ACSA's purchase of the 240 hectare Denel property. Bordering Atlas Road on the east and airport property on the west, two quite different functional zones are proposed for this precinct: (1) a world-class Aircraft Maintenance and General Aviation facility zone and (2) a mixed-use commercial zone.

According to the master plan, the first zone would include continuation of the 34 hectare Denel core area where light manufacturing complementary to aircraft maintenance and general aviation already exists. In addition, this zone would have a series of aprons and hanger bays to accommodate maintenance of all non-SAA aircraft maintenance facilities. It would also house FBOs and related general aviation facilities including a Commercially Important Person (CIP) terminal.

As I pointed out earlier, ACSA should consider an expanded MRO on the future eastern precinct maintenance site to handle SAA aircraft. This could free up SAA Technical in the western precinct for higher and better use when the eastern precinct comes on-line.

The second zone, located on a triangular area bounded by Impala Park on the south, the proposed K86 ring road extension to the north, and Atlas Road to the east, will be organized around two spines that bisect the area, north to south: (1) a landscaped "green corridor" laid out along the existing wetland system, and (2) a pedestrian-oriented "high street" lined with retail and other commercial facilities. The latter would include a quarter composed of 3–4 story office buildings and a conference and exhibition quarter designed to take advantage of its proximity to the new midfield passenger terminal. A residential quarter made up of 2–3 story walk-up apartment buildings and duplex terrace housing is also envisioned. Market conditions will determine the timing, scale and mix of facilities to be constructed in this mixed-use zone.

Predicated on the future location of Runway 3, the ACSA plan calls for a new northern precinct. The most recent renderings I have seen place this precinct on a narrow strip of land along the R21 highway, just north of the western precinct as identified in Figure 2.6. The current vision has this strip of land being redeveloped as a bulk duty free zone with facilities leveraging its proximity to the airport's runways and new midfield cargo zone. It is also possible that hotels and an expo/trade center will be located on this land.

The most significant future commercial development in the northern portion of the airport will be the new midfield cargo complex and associated Industrial Development Zone (IDZ). The cargo complex, designed to handle up

to 1 million tons of freight and mail annually will consist of a 75,000 m² main cargo terminal, a 15,000 m² express cargo terminal, and 10,000 m² perishables cargo terminal. Along with these will be 110,000 m² of freight forwarder facilities and a dedicated customs administrative block to accommodate 1,000 persons. There will also be the central holding area for trucks and a car park.

Immediately to the north of the midfield cargo terminal the industrial development zone has been laid out to house facilities that will be leveraged by its location next to the new cargo terminal. It is my understanding that a jewelry manufacturing complex has been proposed for this area. While jewelry is certainly aviation-intensive, it is small, light, compact and is very high value to weight. This means that it will likely generate relatively small amounts of air cargo.

With the support of Blue IQ, the IDZ will also be developed as a special economic zone (SEZ). I therefore suggest that ACSA, Blue IQ, and other stakeholders consider using the IDZ primarily for value-adding logistics services (e.g., kitting, sequencing, testing, labeling, packaging, and time-critical assembly and repair). In Chapter 3, I will describe in some detail the advantages that special economic zones provide the airport and businesses in the region they serve. Suffice it for me to note that export-oriented products could be received, tested, stored, assembled, repaired, packaged and shipped to foreign

destinations, essentially outside of South African Customs, allowing streamlined administrative processing and Customs tariff exemptions.

In short, a jewelry manufacturing complex near ORTIA is an OK idea and it could well benefit by being in a special economic zone. However, to optimize land use and special economic zone status adjacent to the new cargo facility, alternative functions such as value-adding logistics facilities would likely better leverage international cargo flowing into and out of ORTIA. The jewelry complex would likely do just as well on one of the Ekurhuleni Aerotropolis highway corridors where it could apply for SEZ status.

As I noted previously, a ring road needs to be completed to connect the airport precincts and other key nodes at ORTIA and adjacent commercial developments. The ORTIA Aerotropolis master plan also proposes that a bus rapid transit (BRT) orbital route be implemented to facilitate connectivity of key nodes, perhaps along the median of the ring road. At later date, when demand justifies, an automated people mover (APM) system may be introduced complementing the BRT, providing for fast and efficient transfers among ORTIA's terminal, commercial precincts and nearby Ekurhuleni Aerotropolis developments.

Together with a redeveloped Rhodesfield and its adjacent areas (to be discussed next), this would create a dynamic aviation-driven multimodal commercial complex that has the potential to become the most significant 21st

century business center in Africa. The Ekurhuleni Aerotropolis will then have developed in both form and function from vision to reality, generating immense economic benefits to the airport, Ekurhuleni, and Gauteng Province. These benefits will ripple through the metropolitan municipality and the province impacting those at all rungs of the socio-economic ladder.

2.5.2 Ekurhuleni Land-use and Transformation Potential

Despite manufacturing employment declines, Ekurhuleni remains an industrial center, with some 40% of Gauteng's manufacturing activity concentrated in its densely developed towns. Much of the city's industrial land falls on the western and southern sides of ORTIA (see Exhibit 2.8), but most industrial use is not aviation oriented. This spatial mismatch poses a major constraint on Ekurhuleni's potential for economic revitalization and therefore must be addressed in the Ekurhuleni Aerotropolis master plan.

There's also a spatial mismatch in a strategically located 200+ hectare area on the western side of ORTIA that could become the multimodal central business district for the Ekurhuleni Aerotropolis: Rhodesfield (see Exhibit 2.9). The Rhodesfield site (including Rhodesfield proper and Rhodesfield ext. 1) is bounded by the Kempton Park CBD beyond Albatross Street to the north, the R21 Albestina Sisul Highway and ORTIA to the east and south, the Gauteng

railway and Isando industrial area to the south and Spartan industrial area beyond Kelvin Street to the west.

The site has superb multimodal access. In addition to being immediately west of ORTIA's current terminals, Rhodesfield is positioned at the nexus of the R21 and R21 highways. It is also on the north-south PRASA rail line with stations immediately north in Kempton Park and south at Isando conveniently serving the site along with Rhodesfield's Gautrain station which offers east-west rapid transit between ORTIA and Sandton and onward to Tshwane and Johannesburg.

As illustrated in Exhibit 2.10, Rhodesfield is primarily residential with some substantial education institution sites and a scattering of commercial and light industrial land uses. The Rhodesfield Urban Design Framework (2010) provided by GAPP/ARUP/V&L conducted a thorough assessment of the site and makes numerous specific recommendations regarding surface transportation connectivity, ORTIA pedestrian access, infrastructure and street layout, commercial re-use, an integration of commercial and residential nodes, both internally and externally.

Demacon has also produced a market study and development framework for Rhodesfield (2010) that provides an analysis and a series of recommendations to improve transportation access, facilitate land assembly into larger blocks for redevelopment and functional re-use. Demacon further analyzes the economic

impact of this functional re-use which they find could generate up to R42.8 billion in business sales annually and 62,600 additional jobs.

These studies and my own at Rhodesfield's site visits suggest that Ekurhuleni is sitting on a job, wealth, and tax-generating commercial gold mine. Properly redeveloped to take advantage of Rhodesfield's outstanding air, highway, and rail connectivity, and the new trend for top-tier business services to be attracted to the immediate vicinity of airports, many of those jobs would be high-paying white-collar positions. These would include regional corporate headquarters jobs as well as marketing, consulting, auditing, and other producer service positions of travel intensive managers and professionals.

There's also a trend for many managers and professionals to live in close proximity to their workplaces. This suggests that a thrust of Rhodesfield's redevelopment strategy should be to provide high-quality residential complexes within walking distance or very short commute to its future office buildings. These residential complexes should be mixed-use also offering upscale dining, shopping, cultural and nightlife amenities to residents and visitors. Since many future visitors may come by an air, appropriate overnight accommodation facilities should be a component of the mixed-use commercial redevelopment.

An ambiance of sophisticated dynamism should be imbued in physical and social revitalization, including distinctive aviation-themed architecture and public space daily events that create a "wow" factor. Ekurhuleni badly needs an

image remake. A Rhodesfield's remake into the Aerotropolis' CBD can and should lead the way.

Benefits would likely spill over to nearby Kempton Park which could see new life pumped into its downtown offices. It might also boost Kempton Park's prospects of becoming a future cultural center as envisioned by Ekurhuleni's Executive Mayor, attracting locals and long-distance travelers alike.

Following this Aerotropolis strategy, Rhodesfield's could be an excellent site for a "five-star" hospital and wellness center for medical tourism. Medical tourism is among the world's fastest growing industries generating substantial revenues on both of these business fronts.

South Africa is particularly advantaged with its climate, natural beauty, and exotic flora and fauna to be a highly attractive destination for medical tourists. A site right next to the continent's best connected domestic and international airport would offer even further advantages for this emerging type of tourism.

As a means to jumpstart Rhodesfield's redevelopment, I would look to the 10-hectare school site next to the Gautrain station. The school site is not the highest and best use of this strategically located property and probably should be relocated. This land, in turn, could be redeveloped as a class-A office park as part of the new CBD for the Ekurhuleni Aerotropolis.

Moving to other areas near the airport, I observed heavy equipment sales and distribution yards and industrial and warehouse areas that have essentially nothing to do with ORTIA. Some of these facilities should also be relocated or demolished to make way for higher and better uses for commercial activity in the immediate airport area.

Apropos the above, an Aerotropolis master plan should be conducted which commences with a thorough census of all land-uses around ORTIA and along its nearby corridors to assess compatibility with the new Aerotropolis model. Zoning and incentives should be developed which encourage aviation-compatible businesses and industries to locate in closest proximity to the airport and to dissuade those businesses and industries that neither leverage nor are leveraged by ORTIA from locating nearby.

2.6 Intermodal Inland Ports and Logistics Villages

Intermodal interfaces and associated logistics facility development will be very important to efficient goods-handling and fast-cycle logistics in the Ekurhuleni Aerotropolis and broader province. Intermodal rail/truck facilities have been particularly critical to the commercial success of some Aerotropolises through the formation of intermodal inland ports and logistics villages that boost the

productivity while reducing the transport costs of aerotropolis industrial and warehouse facilities.

I have found that in order for intermodal logistics infrastructure and facilities to maximize their contribution to local industrial and distribution productivity, three pre-conditions need to be met. First, the mechanisms of close coordination among shippers, truckers, distributors, warehousers, railroads, airlines, and consignees for the rapid expedition of shipments need to be developed. Second, intra- and intermodal integration is required in terms of networks, physical interfaces, schedules, and fares. This will, in turn, require much more extensive coordination among the major municipal planning agencies in the province as well as coordinated planning among the various transportation service operators (e.g., Gautrain, PRASA, Spoornet, ACSA, and highway departments at the municipal, province and national levels). Third, the multi-modal facilities themselves need to constructed and operated efficiently.

I build on the experience of U.S. intermodal inland ports in specifying guidelines and, as an exemplary case, use one successful inland port as a point of reference. The guidelines are general guidelines that will need to be adapted to unique Ekurhuleni Aerotropolis and Gauteng intermodal logistics sites a number of which are in operation or identified in Ekurhuleni and Gauteng Province planning documents. These sites include, among others, City Deep, Sentrarand,

Tambo Springs, West Rand Logistics hub, Rosslyn Logistics hub and Vaal Logistics hub.

Exhibit 2.11 outlines the basic intermodal logistics support infrastructure required for operating inland ports. The critical elements (some of which are already well established in Ekurhuleni and Gauteng) are a rail spur (shuttle) directly to the land port and selected logistics zones connected then by an extended rail line (shuttle) to ports, a suitable site where truck cross-docking can occur, and sufficient market area. Each is a necessary requirement. On the right side of the exhibit, supplementary functions are listed. Ekurhuleni has immediate proximity to ORTIA's are cargo facilities and the industrial development zone to be associated with the new midfield air cargo terminal. It does not appear feasible, however, to have a direct rail link to this particular IDZ.

Intermodal logistics complexes can be particularly successful in generating air cargo for nearby airports as well as supporting nearby industry. Successful cargo airports in the U.S., such as those at Alliance, Texas and Huntsville, Alabama, are frequently strengthened by an inter-modal rail facility.

One model for the Ekurhuleni Aerotropolis may be the Virginia Inland Port (VIP) in the U.S. State of Virginia which has been in operation since 1989. It provides an example of one potential ground layout and, despite several differences, a potential guide to operation. Exhibit 2.12 presents VIP's general

layout and land uses. The inland port is a U.S. Customs Port-of-Entry, is circumscribed with a Free Trade Zone, and has a 1,400 foot boundary with Norfolk Southern railroad. VIP is served by scheduled rail service to Norfolk six days per week (312 trains annually) which gives shippers access to the trade routes of approximately 75 international shipping lines. Its strategic purpose was to capture a portion of the traffic from the U.S. Midwest that might otherwise go to Baltimore or Philadelphia.

As illustrated in Exhibit 2.13, the land set aside for the inland port needs to be long in order to facilitate loading and unloading. The site should be expandable as throughput increases. Noise buffers need to be established around the site and cargo traffic separated from personal automobile traffic. Immediate highway access and clustered distribution centers are critical because local drayage is sufficiently expensive as to undermine the potential efficiency advantages of many proposed logistics and distribution centers.

I looked at a number of sites close to the center of the Ekurhuleni Aerotropolis to see if a successful inland port and potential adjacent logistics village could be developed to support fast-cycle logistics. Aerial photographs and Google mapping indicated a potential site as shown in the aerial photograph in Exhibit 2.14. This site is west of Jet Park Road and Pretoria Road (M57) and east of Quality Road and Industrie Street. While basic infrastructure appears in the aerial photo to be in place, the site needs to be assessed by those who are far

more knowledgeable than I to judge if it is feasible, and, if potentially feasible, desirable to be developed as an intermodal inland port.

In so doing, careful cost estimates are needed for such a facility, including the rail shuttle service to ports. The Ekurhuleni Aerotropolis's efficacy as a transshipment point depends critically on trade volume and on being able to offer cost-effective services that create value for shippers. While the proposed highway and rail infrastructure investments I noted previously can help alleviate congestion and reduce delays, terminal costs must be sufficiently low and the quality of service sufficiently high to attract users. Frequency, speed, delivery time predictability, and cost of long distance transportation are area's of concern. So is the cost and quality of terminal service.

Intermodal inland ports, while increasingly important logistics resources, are complex organizations. Their successful operation requires the fulfillment of many roles and responsibilities. These include those for real estate, terminal improvements, financing, providing the terminal equipment, supplying line haul and rail shuttle equipment, designing operating systems, overseeing terminal operations, coordinating railroad operations, and marketing. It may well be most effective and essential for the Ekurhuleni to bring in an experienced intermodal inland port operating company from the U.S. or Western Europe to handle these complex tasks should the decision be to move forward with one near the airport in the future.

Logistics villages may also play an important future role in the development success of the Ekurhuleni Aerotropolis. Many logistics villages operate in the U.S. and Western Europe as inland ports, allowing for Customs and other formalities to be cleared far away from busy land-starved container ports – "offporting." Moving such processes inland encourages the use of intermodal transportation chains. Many inland ports also function as free trade zones allowing the payment of import duties to be delayed as long as possible.

Exhibit 2.15 presents one possible schematic view of the development of logistics (freight) village functionality over time. Functionality can increase as traffic increases, meeting minimum thresholds for a growing set of ancillary services. As each threshold is reached the services which reduce unit production and shipping costs can be supported, increasing regional competitiveness.

As described by Weisbrod et al., "Freight villages reflect a modern way of organizing logistics, transport and goods distribution activities and usually include warehouses, distribution centers, storage areas, offices, truck services, bank, postal, insurance services and in certain cases Customs infrastructures." While there are several definitions, most include intermodal transport and the active management of shared facilities as keystone features. A few include the condition that the goods remaining in the same transport load unit for the entire journey but others include load aggregation and disaggregation in their definitions. Shared services differentiate the functional concept of "logistics

village" with freight planned unit developments and that differentiation provides a useful clue to Ekurhuleni Aerotropolis property developers seeking to provide the maximum advantage to tenants at the minimum cost.

Exhibit 2.16 provides an overview of logistics village characteristics, activities, and services. In addition to the core logistics activities, logistics villages provide common security and facility maintenance. Office space and conference facilities are often on-site. A broad array of user services including restaurants, business services, and local/regional public transportation may also be made available. Further services include hotels, vehicle repairers, and career development facilitation such as training and employment agencies. Particularly in Asia, logistics facilities and their support services are often concentrated into specific urban areas by strict land use controls. In such cases, urban planners have often created competitive markets for service providers, ensuring efficient overall operation.

Because of the number of promising sites for logistics villages in Ekurhuleni and Gauteng, and excellent convergence of national highways and rail lines, city and province officials have a propitious opportunity to develop or further improve the multimodal infrastructure and facilities to boost fast-cycle logistics. Coordinated planning needs to commence for the space, integrated intermodal interfaces, and physical plant requirements for logistics villages or jointly agreed upon sites. Planning also needs to commence for the commercial

and logistics support services which will increase the value for tenants and users of these villages for long-term returns to Ekurhuleni and Gauteng Province competitiveness and economic development.

2.7 Air Logistic Hub and Aerotropolis Infrastructure Design and Configuration

From the start, I have emphasized that one of the most important competitive attributes for an Ekurhuleni Aerotropolis will be fast-cycle logistics built around efficient multimodal transportation systems, anchored by air cargo. In the following sections I elaborate further the infrastructure and facility planning guidelines that should be followed in implementation of an Ekurhuleni Aerotropolis fast-cycle logistics system with emphasis on the future development of (1) ORTIA's new midfield cargo terminal, (2) its adjacent IDZ recommended to be a value-adding logistics Special Enterprise Zone, and (3) related northern precinct logistics facility development. Together these areas and their facilities, along with connecting intermodal interfaces, will constitute the primary components of an ORTIA Air Logistics Hub. I will also provide infrastructure and facility guidelines to support logistics villages and time-critical distribution in the Ekurhuleni Aerotropolis and greater province to complement and be leveraged by this air logistics hub.

2.7.1 Future ORTIA Cargo Area Facilities and Design

An essential feature of a ORTIA Air Logistics Hub (OALH) will be the aforementioned new midfield cargo terminal which will cornerstone a future zone of air cargo and value-adding logistics facilities in the northern portion of the airport (see Exhibit 2.6). It also appears possible that the current strip of ORTIA's older cargo handling facilities north of its western precinct can be modernized and reconstituted as an interactive bulk duty free zone (as previously discussed) with a direct road access. The strip might also be used as an additional value-adding logistics and business-support complex to complement ORTIA's midfield IDZ and serve Ekurhuleni's time-critical goods processing businesses.

As also discussed previously, the new midfield cargo terminal will be a shared facility attractive to all cargo carriers including express facilities and a perishables center (PC) to support in-transit and South Africa's high-value agricultural, floral, and fresh fish shipments. It would also have a large state-of-the-art forwarders building and a Customs Clearance Center (CCC) for international cargo.

Immediately north (adjacent to) the midfield cargo terminal will be the IDZ. This, as I contend, should be developed as a value-adding Logistics Special Enterprise Zone, with value-adding logistics facilities that support are leveraged

by and the importing and exporting of perishables, parts, components, and assembled products via air cargo.

The IDZ would generate substantial air cargo volumes for ORTIA while supporting the fast-cycle importing, exporting, and value-adding of Ekurhuleni Aerotropolis and Gauteng Province businesses. With Special Economic Zone status, private-sector firms would occupy IDZ buildings considered outside of South African Customs. They therefor can engage in tax exempt, duty free, and administratively streamlined processing, assembling, testing, packaging, kitting, sequencing, labeling, and trade, as I will discuss further in Chapter 3.

Being immediately adjacent to the midfield cargo terminal, product transfers will be accelerated so that only two hours or so after an aircraft arrives, value-adding processes can begin. The reverse holds for exports with the value-adding processing taking place up to just two or three hours before aircraft depart for international markets.

In addition to value-adding logistics processing facilities, the IDZ could contain time-critical light manufacturing and repair facilities as well as low-rise office buildings for third- and fourth-party logistics providers. Low-rise office buildings for financial services (e.g., letters of credit) and cargo airlines could likewise be provided. The entire complex should have advanced optical fiber networks for electronic data interchange (to be described shortly) with back-up power generators to insure no power outages.

2.7.2 Guidelines for ORTIA Cargo Facility Design

Three key principles of agility should be followed in the design for the future ORTIA cargo facilities and new northern logistics area: (1) Flexibility; (2) Targeted Mechanization; and (3) Expandability/Phased Growth. Building agility into the processing capability and location of facilities is essential because of: (1) unpredictable longer-term cargo handling demands at ORTIA; and (2) a dynamically changing and improving technological and logistics environment.

Flexibility

A critical design requirement of future ORTIA cargo facilities is that their development should be demand-driven and responsive to changing needs and requirements of ORTIA and the IDZ's tenants and users. A flexible, incremental development approach is highly recommended, given the difficulties of forecasting the exact types and levels of cargo and logistics activities at and around ORTIA. Thus, for example, advanced automation of material handling systems or full-scale development of intermodal connectors and interfaces may not be prudent in the short-term implementation of the new midfield terminal. In the design of most processing systems, cost, flexibility of operation, and

operational efficiencies demand appropriate cost/sophistication compromises at different stages of infrastructure and technology development.

Three realities should be considered in initial automation of cargo village materials handling and processing systems: (1) the future ORTIA Air Logistics Hub (OALH) will likely have to accommodate all manner of aircraft and cargo equipment (i.e., standardization of aircraft gauge and related cargo handling equipment for serving domestic and international air cargo markets are currently not possible); (2) non-automated materials handling and accumulation (short-term storage) systems are often more cost-effective and flexible in terms of meeting peak requirements and other unanticipated immediate problems by simply providing more forklifts and manpower to meet unexpected or peak requirements; and (3) longer-term air cargo demand and other transportation mode cargo demands are difficult to forecast in turbulent national and global economic environments.

Whereas forecasts have been made of up to 1 million tones of cargo at ORTIA by 2025, only as actual demands are experienced over time for such a multimodal logistics complex would it be possible to incrementally predict materials handling equipment, logistics infrastructure, and facility needs, and to gain verification of the estimated industry mix of cargo demands placed on the ORTIA's cargo terminal and other cargo facilities (e.g., aerospace parts and components, pharmaceuticals, fresh cut flowers, seafood and other perishables,

retail distribution products, etc). For these reasons, it is recommended that the ORTIA's cargo areas continue its current operations with relatively less expensive, lower-tech systems. These can be upgraded over time as the demand and future tenant requirements become better known and the benefits to be acquired through automation become better understood, measured and demonstrated.

One means of attaining processing flexibility, and commonly employed in modern just-in-time (JIT) operations, is to create subsystems that have multiple processing equipment rather than one large processing system. Designing one large system often appears to offer economies of scale (i.e., less cost per unit produced as process equipment size increases). Such all the eggs in one basket type of operation, however, could easily lead to inflexibility and an inability of ORTIA' cargo managers to shut down part of the total process capability for maintenance, equipment testing, equipment enhancing and even off-line employee training.

To save initial expenses and promote flexibility, mobile equipment is generally preferred to fixed position equipment (e.g., a mobile nose loader/unloader as compared to a fixed-bridge nose loader/unloader). Ideally, all equipment should be readily reconfigurable and rearrangeable as operations layout requirements change over time. I have found that some fixed position equipment (e.g., automated conveyors attached to the floor or hung from the

structural system) actually hinders the “fluid” design concept I've recommended for the ORTIA's midfield cargo facilities.

Targeted Mechanization

Related to the above, and as ACSA is aware, experiences of air cargo operations at other major international airports do offer guidelines for the degree of mechanization in ORTIA cargo operations for efficient materials handling. ORTIA's existing mechanization of standard cargo processing operations such as container consolidation, container breakdown, and conveyors to accommodate x-ray equipment should be included in all new ORTIA cargo facility operations. As noted, more advanced automation of cargo processing operations should be provided only when and where it is clearly demand driven and economically justified. With a little over 300,000 tonnes of cargo annually at ORTIA, introduction of the most advanced automated cargo processing technology could be well in the future.

When ORTIA's future cargo demands over time become better known and closer to when the new midfield cargo terminal will be completed, evaluations of potential productivity benefits of automated equipment and facilities can be assessed and enhancements implemented to take advantage of increased operational improvements. Cargo space construction should also be

incremental and demand driven. As available cargo facility space new space should be added and with increased activity, pallet racks should be provided to gain better use of the facility cube. Similarly, when sufficient put-away and picking requirements develop, fork-lift use would be discontinued for automated put-away and picking of cargo from racks and replaced by computerized rail-guided picking and put-away equipment.

Expandability/Phased Growth

I have been emphasizing that future demands placed on ORTIA's Air Logistics Hub (OALH) facilities and their resulting space needs are difficult to predict with any confidence. This is why I proposed that facility development encompass flexible, evolutionary and phased growth. The same is true for the IDZ.

While midfield cargo facility requirements are no doubt being estimated by ACSA based on cargo forecasts, the midfield facility and associated IDZ must be allowed to become what it needs to be as actual cargo and market demands and other requirements reveal themselves over time. Thus, the design guidelines proposed herein are not so much a fixed plan as they are a flexible framework to accommodate a wide variety of cargo aircraft, tenant facilities, regional users, and physical layouts.

The above framework allows for OALH development to be modified as cargo and market demands, resources, new technologies, and infrastructure advances occur. Thus, the new midfield cargo facility and value-adding logistics SEZ facilities should employ a modular layout for maximum flexibility and phased development. Ground transportation designs should incorporate redundant routings and flexible road systems to minimize the impact of congestion or accidents, both within the cargo and logistics areas and in connecting highway systems. Rights-of-way should be sized to allow future expansion without negatively affecting ongoing aircraft or highway operations. These same guidelines should be applied to ORTIA's future commercial development in its western, southern, and eastern precincts and to future Ekurhuleni Aerotropolis development zones.

ORTIA's aviation infrastructure will no doubt be periodically be updated with state-of-the-art (probably NextGen) navigational aids to allow for growing air capacity demands and eliminate periodic weather delays. It is also important that appropriate outside the fence zoning controls minimize potentially conflicting land uses and noise problems that could preclude the extensive 7-day, 24-hour airport operation as ORTIA's aviation operations grow.

ACSA and Ekurhuleni government agencies likewise must be prepared to respond rapidly and creatively to evolving inventory, tenant and user needs and an ever-changing business environment; hence, ORTIA and Ekurhuleni

Aerotropolis officials must be agile as they creates or coordinate "one-stop shop" support for tenants and regional users from each logistical, industrial, or commercial sector. Indeed, ORTIA management and Ekurhuleni government agencies may not only wish to jointly market the OALH and Aerotropolis, but also operate as strategic partners with tenants and other outside the fence developers in dealing with other government agencies and in seeking access to a full range of technical, financial, and political resources to facilitate ORTIA's and Ekurhuleni Aerotropolis logistics and commercial development.

Consistent with ORTIA's and Ekurhuleni's emerging "green" principles and ISO 14000 standards (international standards that enable companies to systematize and improve their environmental management efforts), maintaining environmental quality and safety are a fundamental objective of logistics planning and Aerotropolis development. The logistics system must provide facilities and procedures for the handling, storage, transportation, and disposal of environmentally sensitive materials as a continuous process. Likewise, modern utility systems must offer high-quality and reliable power, water, natural gas, wastewater treatment, and solid-waste disposal to meet future tenant needs in the developing cargo and logistics areas as well as ORTIA's Airport City and the broader Ekurhuleni Aerotropolis.

Each potential cargo, logistics, industrial, and commercial tenant at ORTIA and the Ekurhuleni Aerotropolis should be evaluated for its

compatibility with environmental regulations and standards. A host/tenant partnership should address the requirements for operating within acceptable environmental parameters jointly. Innovative site planning and design should ensure visually attractive development with ample landscaping and aesthetic touches. Existing shabby-looking facilities and equipment should be removed or screened from view both on the airport and along Ekurhuleni Aerotropolis corridors.

Ideally, logistics, cargo and light industrial clusters at and around ORTIA should appear more like a university campus than a traditional industrial/ warehouse area. To the extent feasible, cargo flows and passenger flows should be segregated from each other both on the airport and nearby.

Although cost savings remain important in today's business location decisions, ORTIA management and Ekurhuleni Aerotropolis officials should operate under the assumption that tenants and investors will pay more for integrated, high-quality, reliable services and sound environmental planning. Because a delicate trade-off exists between costs and on-site services, however, cost effectiveness will be optimized by the phasing of development to minimize initial investment and location costs for tenants. Development of the overall site infrastructure and facilities at ORTIA and its surrounding aerotropolis should be incremental, demand-driven, modularized, reconfigurable, and be as attractive as possible.

Further flexibility in ORTIA's midfield cargo/IDZ complex area as well as ORTIA's Airport City would be achieved by oversizing and reserving spacious rights-of-way for future infrastructure and facility expansion. ORTIA's internal transportation corridors of its logistics and commercial zones linking these nodes to external transportation corridors also should be oversized to meet increasing traffic levels over time and to accommodate future developments in vehicles and transport systems. The same internal corridors should have all the underground utility channels needed for powering and servicing airport goods processing firms and shared support facilities. This includes designing corridors with rapid and flexible plug-in telecommunications capability for tenants, as needed. Again, all this applies to Ekurhuleni Aerotropolis zone planning and development, as well.

2.7.3 Guidelines for OALH and Ekurhuleni Connectivity

An ORTIA Air Logistics Hub and Ekurhuleni multimodal logistics system must be able to accommodate a broad variety of transportation origins and destinations to and from it in the mid- and long-term phases. Flow paths of domestic and international air, water, truck and rail modes are represented in Exhibit 2.17 as they might occur between the ORTIA, the Ekurhuleni Aerotropolis, and domestic or international origins and destinations at ultimate

development. Flow paths of intra-OALH cargo are shown within the boundaries of the OALH in the exhibit. Truck, potential rail and air cargo terminal links are included as nodes of the cargo transfer system. Truck cross-docks and a truck or tram (or rubber wheel vehicle) based cargo transfer system (CTS) may serve to connect ORTIA cargo and IDZ facilities with off-airport rail as the OALH develops in later phases.

Regional truck transportation should be available between all major Ekurhuleni Aerotropolis and Gauteng Province industrial/warehouse nodes and the OALH. Truck shipments consigned to OALH tenants will most likely be delivered directly to those tenants. Deliveries to consignees located further from the OALH should be delivered to appropriate truck terminals for processing and subsequent delivery to the consignee.

Good truck and rapid freight rail transportation to South African ports will be required if the Ekurhuleni Aerotropolis is to achieve full quadramodality (air, highway, rail, sea connectivity) in its fast-cycle logistics. Though there tends to be limited air-vessel product movement, bringing all capabilities together at the Ekurhuleni Aerotropolis will create the critical mass of logistics infrastructure and facilities that will make it a powerful magnet for industry. I will return to this point in the next chapter.

2.7.4 Electronic Data Interchange and IT System Guidelines

To support 21st century business practices of electronic commerce, just-in-time delivery, and supply chain management, electronic data interchange (EDI) must be provided as a tool for OALH/Ekurhuleni Aerotropolis facility operators, tenants, logistics service providers, and South African Customs. The EDI system will be a network of computers and databases that provide an interface between all parties involved in arranging a shipment. This EDI system must be capable of interfacing with multimodal carrier systems to provide on-line tracking and tracing capability for both the shipper and consignee. A key function of this system should be to interface with South African Customs. The EDI network should also have access to global telecommunications networks via satellite transmission. Similarly, the EDI system should be tied to a bar-coding or preferably more advanced RFID (radio frequency identification) systems for shipment identification within the system and in-transit. The general objectives of the EDI system, consistent with the communication vision of 21st century business practices are to:

- Build a cost-effective, resilient, and manageable EDI network throughout the Ekurhuleni Aerotropolis and beyond that is web-based and open architecture.
- Allow all of South Africa's businesses to connect to the OALH via a network backbone at lowest charges possible.

- Ensure connectivity by providing enough fiber optics bandwidth and connection channels.
- Ensure capacity so that the South African business community and OALH/Aerotropolis tenants can connect and not be denied access due to insufficient electronic ports.
- Provide support for all protocols required by the users of the system.
- Allow tenants, users, and logistics service providers with a range of hosts (e.g., workstations with high-speed network access, mobile computing and data exchange via secure WiFi, WiWan and fiber networking) to connect to the OALH's network.
- Allow ORTIA tenants and the Ekurhuleni Aerotropolis user community to access applications (e.g., database inquiries/updates) on a range of different information management systems operated by third-party entities.

Conceptually, the OALH Communications System can be viewed in Exhibit 2.18 This exhibit presents a vision of a possible future global communications system for the ORTIA Air Logistics Hub. Further details on this system with special attention to accelerating Customs clearance at ORTIA and other logistics processes will be provided in Chapter 3.

2.7.5 ORTIA Air Logistics Hub/Ekurhuleni Aerotropolis Planning Integration Strategy

As described in the previous sections, the ORTIA Air Logistics Hub (OALH) represents a new kind of logistical center in which information technology, transportation, perishables, and supply chain activities are operationally

integrated to create a seamless business environment. Traditional airport master planning activities do not capture the intersections and linkages that are necessary to create this new environment.

The proposed integrated planning process at and around ORTIA must differ from traditional planning processes in three respects:

1. Shift from Element Focus to Process Focus. Traditional master planning typically targets individual elements of multimodal infrastructure in separate plans; for example, independently produced master plans for rail, ports, highways, and the airport. Each of these master plans is based on traditional roles and functions of these infrastructures. In a process-oriented plan, the exercise begins with an understanding of the integrated business processes and seamless multimodal transportation needs of the tenants and customers. In this new approach, the design concept for an intermodal rail facility or logistics village in the Ekurhuleni Aerotropolis should be guided by the desire to create value for its tenants and users rather than to maximize the utilization of designed capacity. This will involve a close coordination and integration of all elements of logistics infrastructure and facility planning for the OALH and the greater Ekurhuleni Aerotropolis.

2. Identify New Elements of the OALH and Ekurhuleni Aerotropolis. To achieve success, both the ORTIA Air Logistics Hub and Ekurhuleni Aerotropolis will require new elements of infrastructure. In the 21st century, businesses compete based on how efficiently and creatively they manage information to create competitive advantage. Even Fred Smith, Chairman of FedEx, has described his large air express company as an IT firm that happens to fly airplanes. The provision of information technology therefore is not an afterthought, addressed once the size and function of a building or infrastructure have been designed, but rather an organizing principle around which the identity and function of a building or infrastructure have been designed. In this process planning environment, information technology capabilities must complement and reinforce the development of multimodal transportation and logistical capabilities at ORTIA and throughout its surrounding Ekurhuleni Aerotropolis.

3. Establish New Linkages Between Infrastructure Elements. The creation of a 21st century infrastructure environment at the OALH and the Ekurhuleni Aerotropolis requires new linkages among key infrastructure elements. Uninterrupted flow of people, products, and materials through the OALH and the aerotropolis require the

integration of various modes of transportation. It is therefore necessary to plan the material handling and management systems that will integrate the movement of goods and materials from across these modes regionally and nationally and to and from ORTIA and its surrounding aerotropolis business facilities.

2.7.6 Designing for Future Tenant Business Needs

The ultimate success of the future ORTIA Air Logistics Hub will depend on how well it meets the needs of future tenants and users, and serves the broader Ekurhuleni Aerotropolis and Gauteng Province business community. The real customer for the planning process is not ORTIA management or any government agency, but firms that ACSA, Ekurhuleni and the greater province wish to recruit. Therefore, concepts and capabilities targeted to 21st century business practices described below should guide and inform the planning process and the required functionality of ORTIA and the Ekurhuleni Aerotropolis. These businesses require the following:

- Paperless Environment. Companies are rapidly moving to a paperless environment in which orders for materials as well as finished goods are transmitted electronically from customers worldwide to their suppliers. Global manufacturers and perishables providers are insisting that their suppliers communicate electronically, and the availability of access to global communications and information networks will qualify future OALH tenants and Ekurhuleni Aerotropolis firms, large and small, for new commercial demands.

- End-to-End Supply Chain Visibility. The ever growing imperative for speed and lower costs has caused companies to more closely manage their manufacturing supply chains and perishables cool chains. The basis of competition has changed from head-to-head competition between companies to a competition that pits supply chain against supply chain. A weak link anywhere along the supply or cool chain can have a devastating impact on a company's ability to perform. Increasingly, companies are requiring end-to-end asset visibility along the entire chain requiring state-of-the-art tracing and tracking information technology.

- Just-in-Time Delivery. As companies manufacture in increasingly smaller lots and provide more customization of their products, the need

for just-in-time delivery has grown. Not only must small batches of materials be shipped as economically as large batches, but they often must be delivered within 36 to 48 hours anywhere across the globe. Traditionally, manufacturers seek suppliers that are located near the manufacturing site. The availability of an integrated information and transportation infrastructure provides the capability for suppliers, manufacturers, and customers to work across great distances as if they were located nearby. This is the new, globally-networked economy in which Ekurhuleni, Gauteng, and South Africa firms now compete.

- Real-Time Asset Control. To assure flexible and fast response to changing customer needs, companies must not only be able to trace and track their assets quickly, but also to change their destination, routing or carrier mode as customer requirements change. Only the complete integration of information, transportation, manufacturing, and cool chain management can provide this capability. A growing portion of multinational companies are able to do this now which will likely become a standard of doing business in the future.

In short, successful development of the ORTIA Air Logistics Hub and Ekurhuleni Aerotropolis intermodal and information technology systems will require a broad understanding of the basic business processes of tenants, users,

and logistics service providers, their current information system capabilities, and new technology business needs. These include better understanding of the emerging needs of information-rich industries such as (1) microelectronics, medical instruments, and telecommunications, (2) logistics, trading and transshipment, (3) aerospace, pharmaceuticals, perishables, and (4) even hospitality industries, including hotels, tourism, and recreation that will form the service backbone of much of Ekurhuleni Aerotropolis commercial development.

Attracting more high-tech manufacturers, assemblers, and global distribution industries will also require a thorough understanding of modern supply chain management principles and the order-to-delivery process. To offer a truly marketable competitive advantage, Ekurhuleni officials should bring together experts in logistics and supply chain management, multimodal infrastructure development, and information technology to collaborate to create the design specifications that properly integrate all system elements. Few locations in the world are doing this, so Ekurhuleni can have a first-mover advantage in attracting high value-adding industries if it takes the lead in seizing this opportunity. This logistics expertise is but one component of the broader functional capabilities required for the ORTIA Air Logistics Hub and greater Ekurhuleni Aerotropolis success to which I now turn my attention.

2.8 Functional Capabilities Required for an ORTIA Air Logistics Hub and Ekurhuleni Aerotropolis

Both the ORTIA Air Logistics Hub (OALH) and Ekurhuleni Aerotropolis should represent integrated responses to new business infrastructure and facility needs I have described. To have its greatest impact on airport and aerotropolis success, it must incorporate six broad functional capabilities targeted to these needs. For each functional capability, examples of key hard and soft infrastructure elements are noted.

1. *Multimodal Transportation System with Access to Local, National and Global Transportation Networks*

On-site cargo terminals and nearby inland ports with efficient intermodal capability should be linked to South Africa's major highway and rail systems and with its sea and air transportation networks. The OALH should provide a seamless interface between transportation modes and between aerotropolis firms and major air cargo (and even ocean shipping) routes so that goods and materials can flow uninterrupted from any Ekurhuleni Aerotropolis location to ORTIA and ports quickly and reliably, at low cost, and with a minimum of human handling. This applies, as well, to air passengers moving between ORTIA and key Ekurhuleni Aerotropolis and Gauteng zones, especially time-sensitive

business executives and professionals. Efficiently linking all the various modes of transportation is important to establishing a time-competitive infrastructure for the Ekurhuleni Aerotropolis and to attracting businesses and industrial investment to the Aerotropolis.

Examples of such Aerotropolis infrastructure needs include:

- Reconstructing the R21/R24 interchange and providing improved roadway access to ORTIA
- Opening a direct Gautrain link between Rhodesfield and ORTIA (or possibly implementing some type of parallel rail shuttle) and integrating PRASA starting Gautrain at the Rhodesfield.
- Constructing a new ring road around the airport and adding bus rapid transit in the median.
- Develop appropriately equipped intermodal facilities allowing quick and efficient exchanges between railroad and road, road and road and rail and rail.

2. *On-site Cargo Processing Capability*

At the core of any air logistics hub must be a cargo processing facility with fast and flexible advanced material handling that can accommodate the needs of a variety of aircraft and products. I noted that flexibility in both the processing capability and location of material handling activities is essential because of nonstandard aircraft and ground cargo-related equipment, and because of a dynamically changing and unpredictable cargo processing environment. Targeted mechanization at ORTIA's cargo

terminals and new northern logistics area, as discussed previously, can be provided when it is productivity-driven and demand-justified.

Examples of key ORTIA cargo infrastructure and facility elements include:

- Midfield cargo terminal and associated value-adding logistics SEZ adjacent to it.
- High-velocity flow-through facilities with airside cargo access and truck cross-docking.
- Automated Customs clearance procedures and facilities.
- State-of-the-art cool chain facilities.

3. On-site Cargo Transport System

A third need for fast-cycle logistics at ORTIA and to efficiently link all its goods-handling facilities in the future northern cargo/IDZ precinct is an on-site cargo transfer system (CTS). The CTS would connect all ORTIA goods handling facilities with air cargo and road access and possibly some outside the fence manufacturers, distributors and logistics providers. These systems can be fully automated, semi-automated or manual (including rubber tire vehicles) depending on traffic flow profiles (cargo demand) and the specifics of the site and should be complemented by appropriate materials handling equipment and information technologies.

Examples of such infrastructure elements include:

- Internal road and cargo tram system (CTS).
- Truck crossdocks.
- Automated storage/retrieval systems.
- RFID tagging systems for tracing, tracking and control of cargo.

4. Shared Communications System with Transparent User Interfaces

Apropos the last bullet point above, computer-to-computer information transfer between companies (Electronic Data Interchange and B2B e-commerce) are quickly replacing paper transmissions and even most traditional face to face supply chain transactions. This electronic interchange of data and information requires message standards, translation software and transmission capability. Recent technology developments have created new opportunities to enhance inter-modal, inter-company and inter-industry communications with harmonized software, more powerful work stations, improved data transportation mediums, global communications networks and faster routers for electronic transmissions.

Incorporating these capabilities and new technologies at ORTIA and the Ekurhuleni Aerotropolis will greatly facilitate seamless relationships between future ORTIA and Ekurhuleni firms and their suppliers and customers—regionally, nationally and worldwide. The net

effect is to accelerate materials handling, customs processing and product transfers among commercial facilities, aircraft, trucks, rail cars, and South Africa's ports. A key planning challenge is to design a communications system that is flexible enough to support the majority of ORTIA and Ekurhuleni Aerotropolis users and firms, that offers rapid connection to local, national and global networks, that maximizes functionality (including effectively communicating across different transport modes), and that allows for continuous improvement and innovation.

Examples of key electronic commerce elements include:

- Electronic data interchange (EDI) and RFID interoperability across transportation modes
- Fiber optic, Wi-Fi, Wi-WAN and satellite networks
- Web-based harmonized software architectures and message standards
- New e-freight and paperless Customs clearance technologies to be elaborated in Chapter 3

5. *Access to On-site and Remote Services for Commercial Support and Logistics Education and Worker Training*

In the new speed-driven economy, businesses are demanding access to a variety of support services that reduce the time and cost of logistical transactions. Desirable commercial support services include a variety of legal, financial, and government services such as the securing of permits,

and export licenses. Some of these services can be provided electronically. Co-location of these services at ORTIA's IDZ or at a strategic point in the Ekurhuleni Aerotropolis can provide a “one-stop-shop” support for ORTIA and aerotropolis investors, tenants and users.

Similarly, electronic access to education and training facilities throughout the world can provide substantial value to ORTIA and Ekurhuleni Aerotropolis firms, tenants, and users. For example, a future distance education facility in Ekurhuleni and Logistics Education and Training Center would provide agile support for customized training of the local labor force by offering Aerotropolis area companies real-time audio, video, and tactile access to knowledge and training resources from around the world. So, if Rolls-Royce wanted to locate a jet engine production facility near ORTIA or elsewhere in the Ekurhuleni Aerotropolis, worker training could be conducted on site, via simultaneous audio, video, and tactile instruction from its European production headquarters.

Examples of such business support elements:

- One-stop (single-window) service center for investors' permits, licenses, etc.
- Interactive audio/video capability.
- Wide area broadband information exchange.

- Logistics education and training center with distance-learning capabilities.

6. Arterial Movements Unencumbered by Congestion

Success of the ORTIA Air Logistic Hub (OALH) and Ekurhuleni Aerotropolis requires speed and agility of movement on local highway systems. As the area develops the potential for congestion rises. I discussed already a number of planned local roadway improvement projects along with new roads needed in the immediate airport area and throughout the Gauteng Province. Gauteng Province agencies such as Blue IQ have endorsed planned upgrades noted previously including additional lanes in high-volume traffic areas. In the longer-term, they should also consider:

- Intelligent highway system technologies.
- Special truck-only lanes added to cargo-heavy airport area highways.
- Integrated Province-wide Bus Rapid Transit (BRT) and Rail Network Plan.
- High-speed rail lines between Gauteng and Durban aligned to go along the Gemiston-Rhodesfield-Olifantsfontein corridor with a station at Rhodesfield that interfaces with the Gautrain and PRASA stations.

2.9 ORTIA Air Logistics Hub/Airport City and Ekurhuleni Aerotropolis Critical Success Factors

Effective planning requires not only vision but also appropriate strategic actions. Guiding the development of a future Ekurhuleni Aerotropolis master plan that includes ORTIA and its associated logistics and commercial development should be a set of critical factors that, if followed, will greatly facilitate ultimate success. Realizing these critical success factors will also provide the Ekurhuleni Aerotropolis with a major competitive edge in attracting business and industry. These factors are the ones most commonly found in successful air logistic hub and aerotropolis developments around the world. ORTIA's Air Logistics Hub and Airport City planning should emphasize these, as should plans for its surrounding Ekurhuleni Aerotropolis.

Critical Factor #1
The Ekurhuleni Aerotropolis Must Be Designed Around Emerging 21st Century Business Practices.

Beginning with my frequently repeated fundamental point, master planning of the Ekurhuleni Aerotropolis (and ORTIA logistics facilities) must reflect not only the best civil and aeronautical engineering practices but also new business practices and needs of 21st century global companies. I noted that dramatic changes are occurring in how companies transact their business, and especially in how today's most successful mega-retailers, high-tech manufacturers and

logistics providers move goods and materials throughout the world in a fast and flexible manner. 21St century airports and surrounding aerotropolises therefore cannot be planned and developed as separate entities that reflect more traditional aerodrome and systems engineering objectives and traditional urban planning practices. New business realities require new business infrastructures. Future airport area logistics complexes must be geared to modern supply-chain management that fuse multimodal transportation, advanced telecommunications, sophisticated materials handling systems, and state-of-the-art business support services to offer unmatched speed and agility to its firms as well as users from throughout South Africa. They must also provide business and leisure travelers with services and amenities that will substantially enhance their experience at the airport and surrounding Aerotropolis.

Critical Factor #2
Development Plans for the OALH, ORTIA Airport City, as well as the greater Ekurhuleni Aerotropolis Must Give High Priority to Quality of Life Considerations.

Unlike most other airport logistics and commercial complexes around the world, the OALH/Airport City should be developed as multi-functional districts that will support not just logistics and distribution activities, but also white-collar service functions, so important to transforming Ekurhuleni's economy and raising salary levels in the airport region. This brings out the importance of quality of life considerations with respect to their broader built environment. By

balancing industrial, commercial, and environmental factors, ORTIA and the Ekurhuleni Aerotropolis can provide benefits not only to the companies that locate there, but also to nearby aerotropolis residents. High-quality design standards, beautified access roads, attractive commercial clusters, and environmental sustainability must be overarching objectives. These, along with their design guidelines will be highlighted in Chapter 4.

Critical Factor #3
Master Plans Must Be Flexible and Reconfigurable.

I have stressed that master plans for both ORTIA and its surrounding Ekurhuleni Aerotropolis should be developed as a flexible framework that can accommodate a wide variety of commercial facilities, tenants, and physical layouts. As suggested above, master planning must look to the long-term, with a design that is both environmentally and economically sustainable, as well as aesthetically appealing. It must also be able to adapt to emerging business needs that will incorporate new technologies and infrastructure advances. A basic planning principle is that, to the extent possible, ORTIA and its surrounding Aerotropolis should be designed as a flexible infrastructure system that can be adapted to changing or future business requirements. While the features of the competitive landscape for the near term are in focus, competitive strategies and logistical requirements will undoubtedly change over time and the

OALH/Airport City as well as the broader Ekurhuleni Aerotropolis must be able to respond quickly to these new business needs and logistical requirements. A 20 to 40 year ORTIA/Aerotropolis development horizon is not unreasonable so the economic and technological environment will undoubtedly change. Development of both should thus be thought of more are marathons than 100-meter dashes, with agility therefore a critical success factor.

Critical Factor #4
ORTIA and Ekurhuleni Aerotropolis Logistics Infrastructure and Facilities Must Establish Synchrony with Others Around the World.

We are moving into an era in which networks of firms compete rather than individual companies. In this new commercial environment, Ekurhuleni Aerotropolis companies and ORTIA tenants must be able to access their suppliers, partners and customers quickly and effectively. This requires logistics facility and infrastructure synchrony with other systems around the globe, with harmonized communications systems and surface/sea/air transportation networks. Major 3PLs and forwarders are racing to set up efficient and seamless international networks. By aligning and integrating more closely into their international networks, ORTIA and Ekurhuleni Aerotropolis goods-handling businesses will be able to participate more efficiently in the global economy that these firms themselves have become inextricably interwoven.

Critical Factor #5
The Ekurhuleni Aerotropolis Should Give Greater Emphasis to the Importance of Fast-Cycle Capabilities in Attracting Globally-Oriented Businesses.

As South Africa's modern manufacturing firms search globally for quality parts and components at competitive prices, and as customers demand quick response and rapid delivery, access to multimodal air logistics hubs will be a major criterion for industrial location. Companies will certainly continue to require traditional economic incentives, such as investment offsets for land or facilities, federal and local tax abatements, and other promotional privileges. However, as the competitive priorities of speed and efficient response to changing customer demand predominate, the relative importance of these traditional factors will lesson. Increasingly, investment decisions will be made as much on the basis of the logistical capabilities of the site and speedy access to global networks, as on government incentives. This could be the Ekurhuleni Aerotropolis's trump card in attracting advanced manufacturers and other high-tech and high-value-adding goods processors.

Critical Factor #6
ORTIA and Ekurhuleni Aerotropolis Planning Must Demonstrate National Benefits.

To obtain broad-based public and governmental support, ORTIA and Aerotropolis development must be positioned as a vehicle for not only

enhancing airport area business development, but also the entire nation's competitiveness and economic growth. The development of a ORTIA Air Logistics Hub that would attract successful business and industries to the airport and Ekurhuleni Aerotropolis should be a primary goal. But, ultimately, the success of ORTIA its surrounding aerotropolis will depend on how its capabilities can leverage businesses and industries throughout South Africa. It is therefore critical that both ORTIA and Ekurhuleni Aerotropolis master planning recognize this fact to design and implement an integrated logistics system plan that builds synergies among national transportation networks and other South African industrial / commercial / agricultural centers. Likewise these plans must create distinct advantages to multinational firms to choose South African over other locations on the continent. ORTIA's extensive route network can be a remarkable asset here if it is leveraged more effectively by the logistics infrastructure and facilities I have described in this chapter.

Critical Factor #7
ORTIA, Ekurhuleni Aerotropolis, and Gauteng Province Master Planning Should Be Totally Integrated.

This integrated planning must bring together airport planning, urban and regional planning and business site planning. Only through such integrated planning can aerotropolis development be economically efficient, aesthetically appealing,and environmentally sustainable. It is therefore essential that constant

and close communication and coordination occur between ORTIA planners, Ekurhuleni, and Gauteng Province planners. Key stakeholders must be brought to the table including SAA, ACSA, Transnet, Metrorail, PRASA, the federal ministries of Economic Development, Transportation, Trade and Industry, and Tourism; councilors and leadership of the Municipality and Province including the Premier and her ministers,organized business and academic institutions.

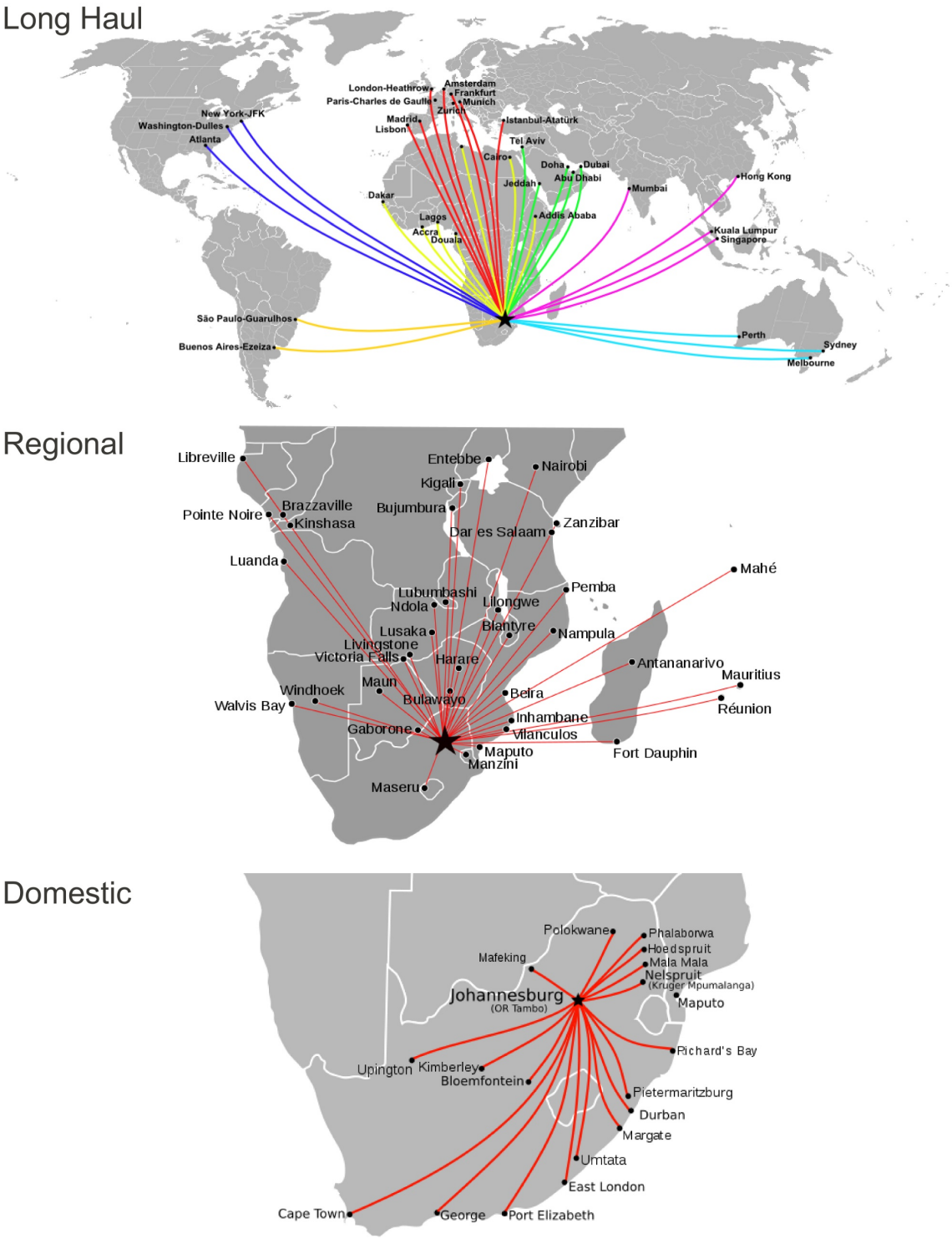
Critical Factor #8
ORTIA Connectivity to Global Markets Must Be Substantially Expanded.

Driving Ekurhuleni Aerotropolis success will be increased passenger and cargo airline connectivity measured by the numbers of markets served by ORTIA and the frequency of air service to and from these markets. It is becoming clear that other African airports such as Nairobe, Accra and Lagos are ramping up to compete vigorously for Africa's passenger and cargo traffic. This will lead to even greater competition for future air routes. ORTIA must continue its practice of aggressively seeking new air service, especially internationally, so it becomes an even more powerful engine fueling commercial and industrial development on its property, the surrounding Ekurhuleni Aerotropolis, and Gauteng Province.

All the above factors will be instrumental to the success of an air logistics hub, airport city, and greater aerotropolis around ORTIA. So too will be creating

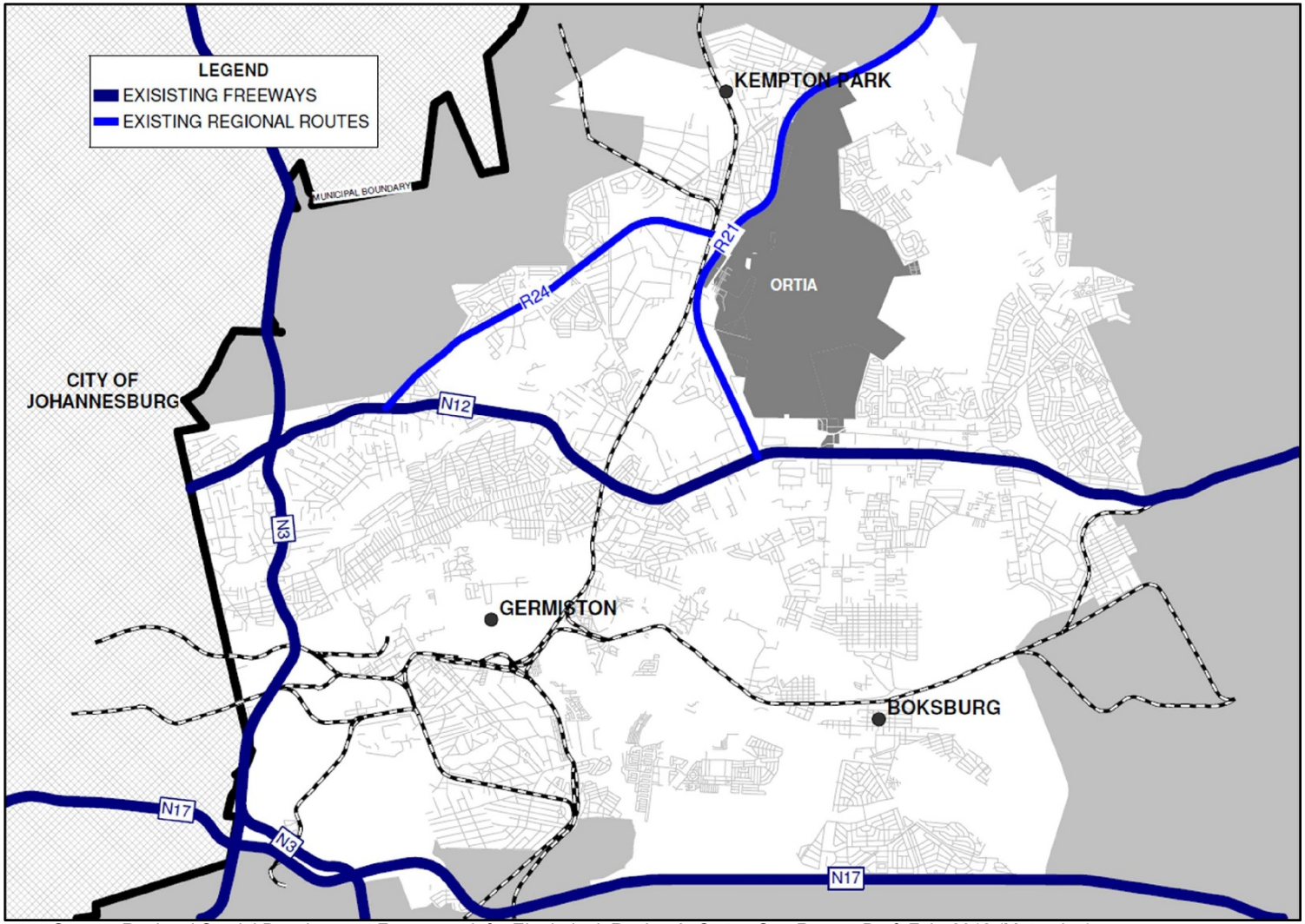
an appropriate supporting business environment and doing the type of careful site and business planning analyses that will attract investors, minimize risks, and ultimately lead to profitable commercial development. The next chapter will elaborate upon these additional critical success factors.

Exhibit 2.1. ORTIA Long Haul, Regional and Domestic Routes



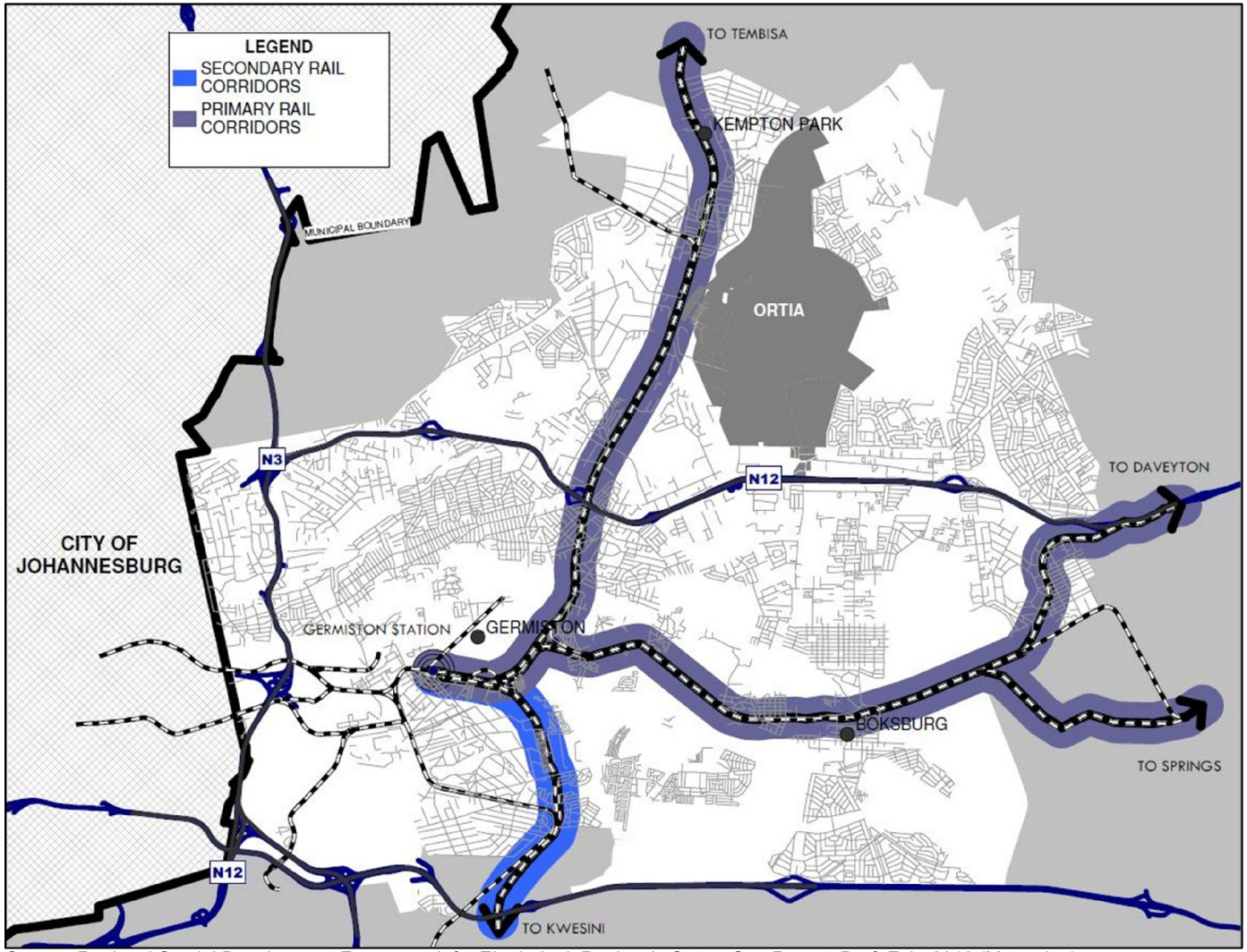
Source: Wikipedia, OR Tambo International Airport

Exhibit 2.2. Highway Nexus in Ekurhuleni Region A near ORTIA



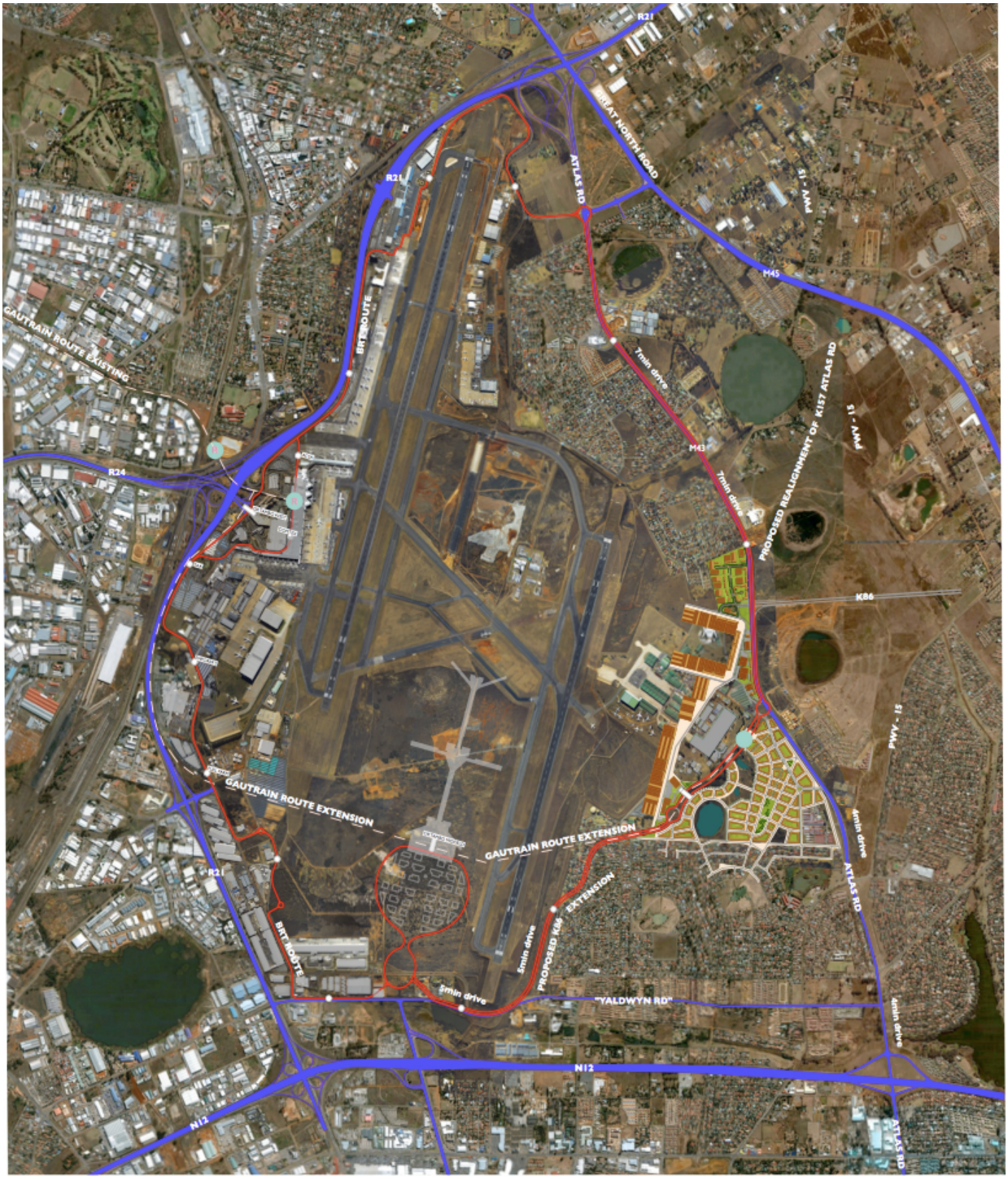
Source: Regional Spatial Development Feramework for Ekurhuleni, Region A, Status Quo Report, Draft Feb. 2012 (Metroplan)

Exhibit 2.3. Primary and Secondary Rail Corridors in Ekurhuleni



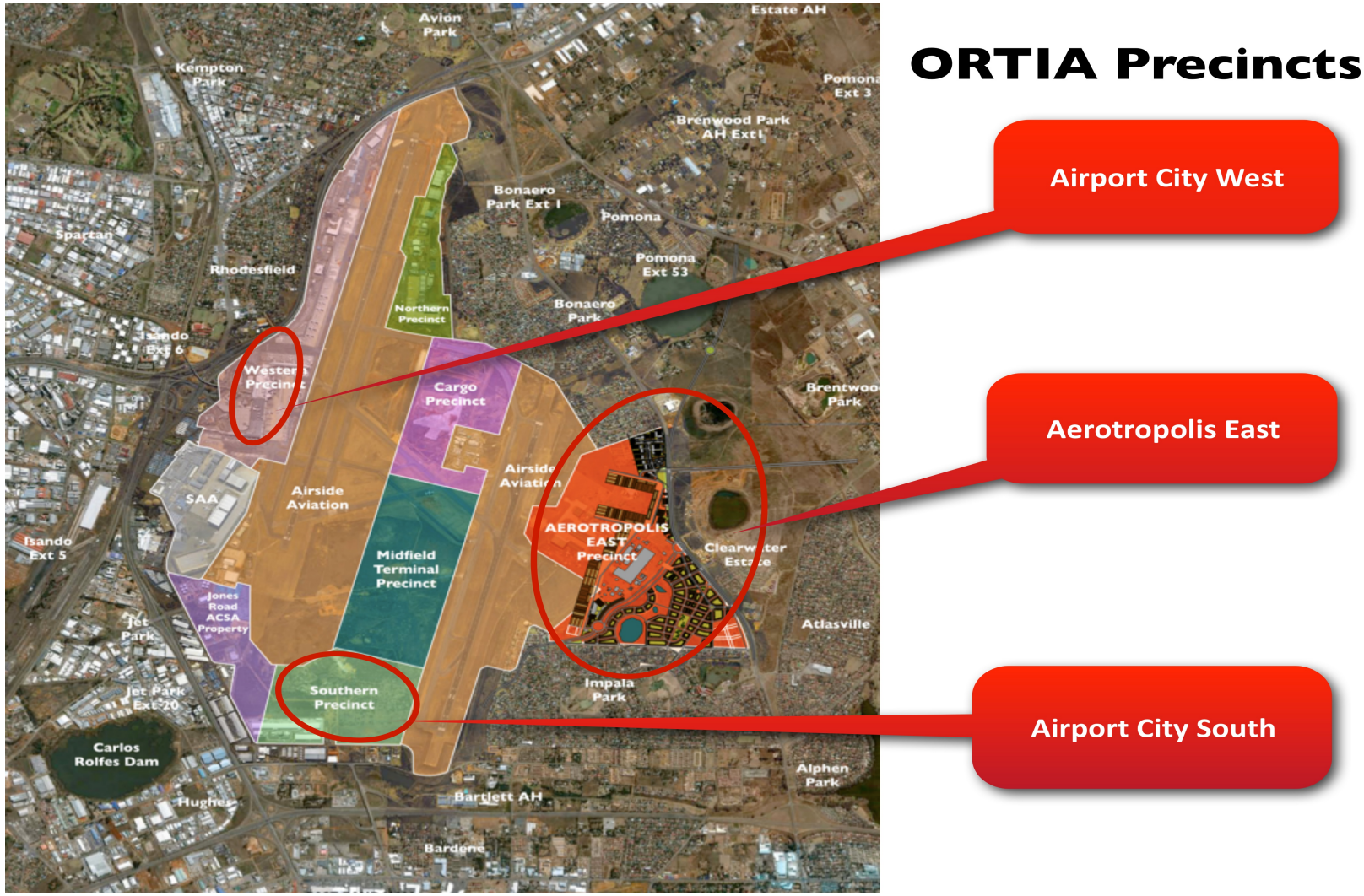
Source: Regional Spatial Development Feramework for Ekurhuleni, Region A, Status Quo Report, Draft Feb. 2012 (Metroplan)

Exhibit 2.4. Suggested Gautrain Extension to New Midfield Terminal and Eastward



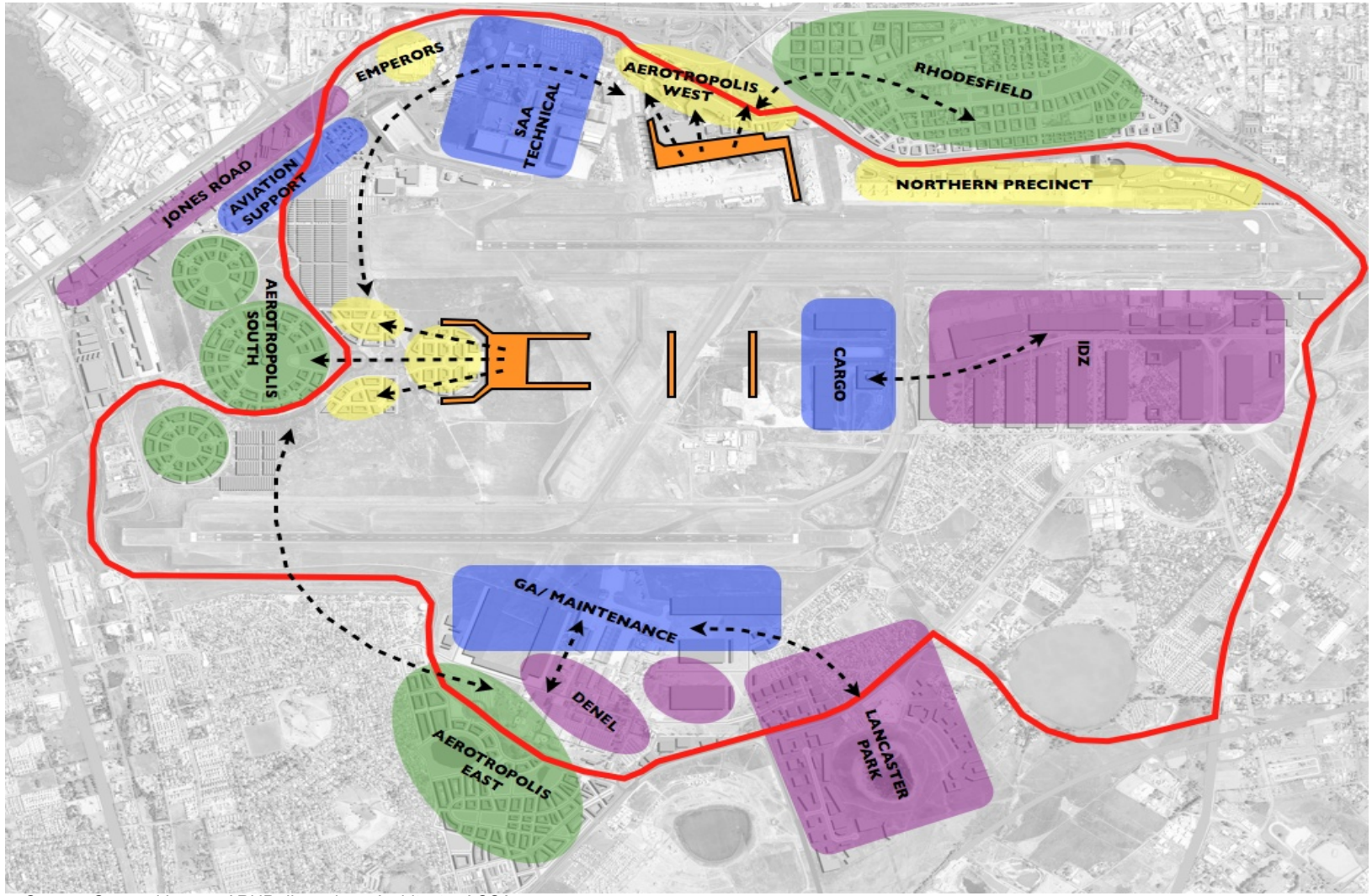
Source: Osmond Lange

Exhibit 2.5. Planned ORTIA Terminal and Commercial Development Precincts



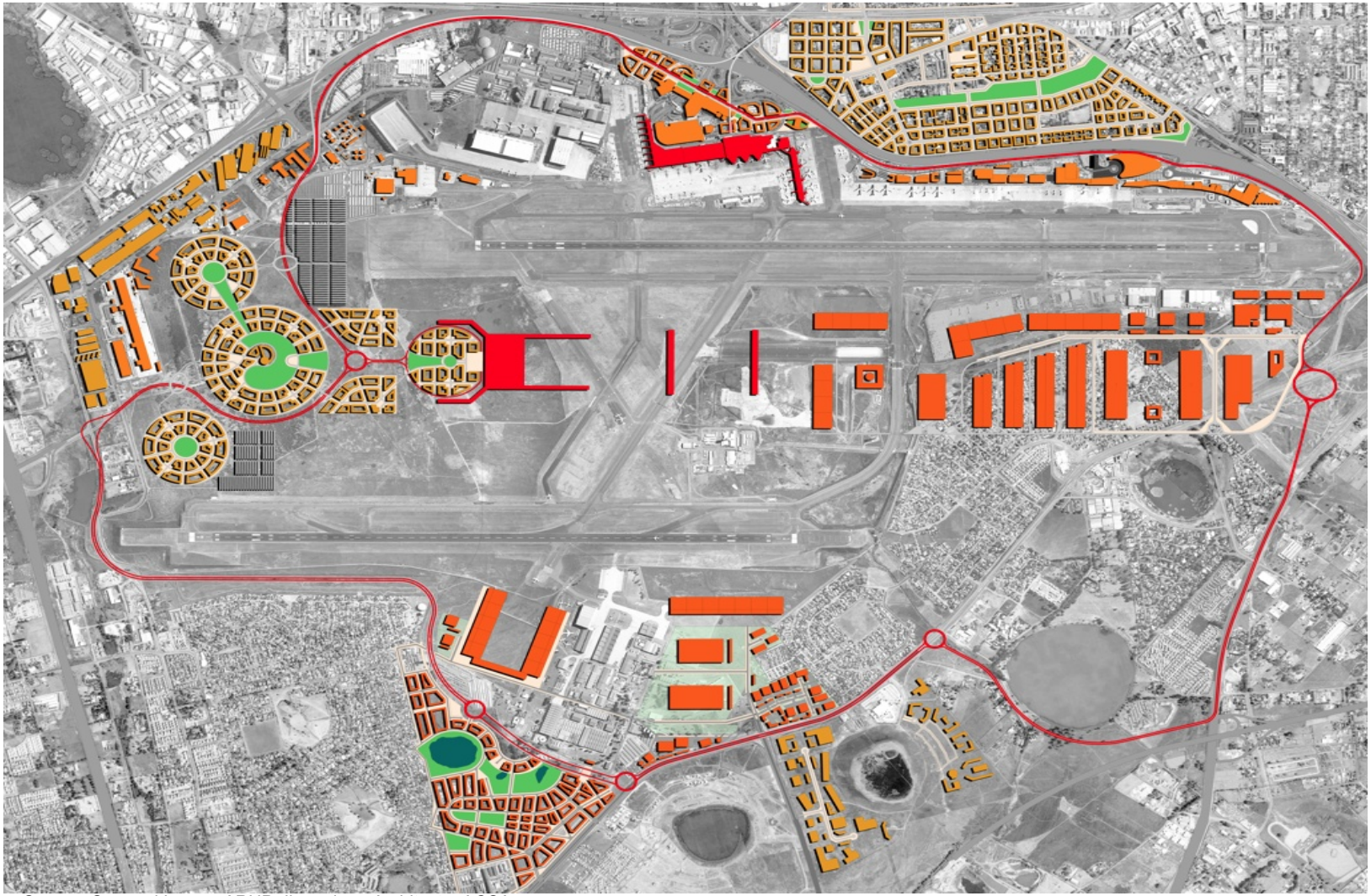
Source: Osmond Lange

Exhibit 2.6. Planned Commercial Precincts with New Midfield Terminals and Ring Road



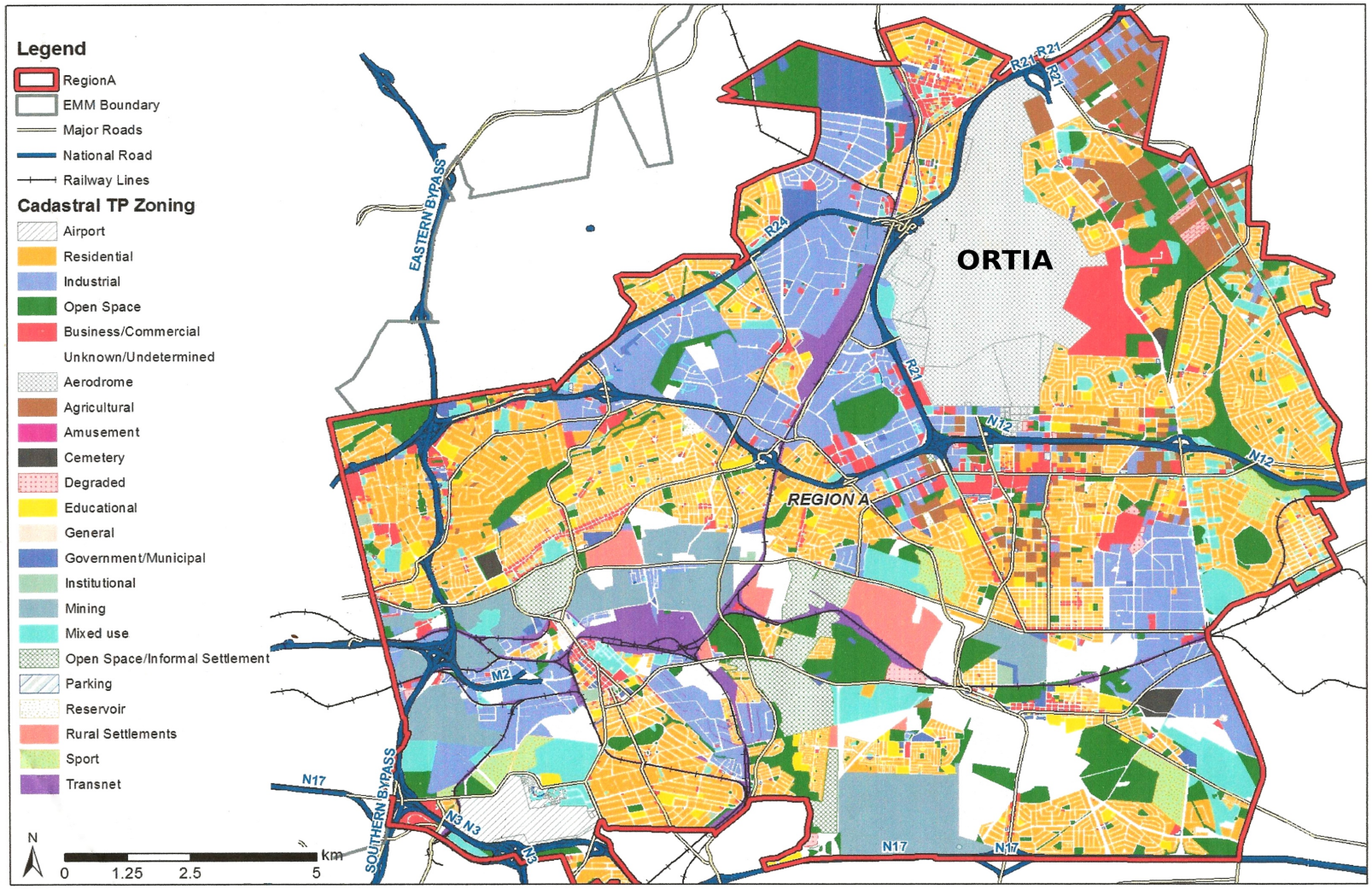
Source: Osmond Lange, ARUP, Ikemeleng Architects, ACSA

Exhibit 2.7 Planned Facility Footprints and Rough Design Pads for Future ORTIA Precints



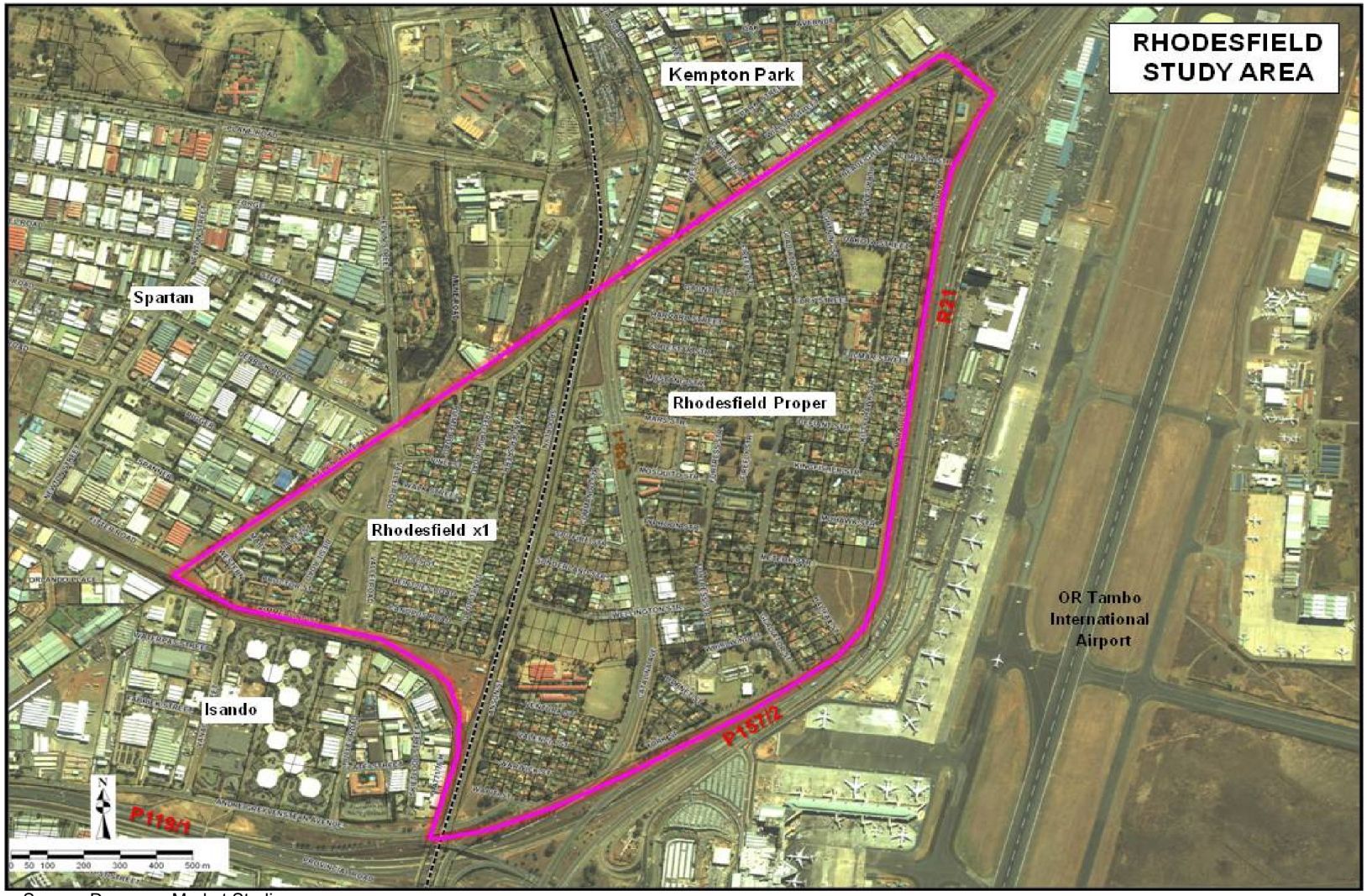
Source: Osmond Lange, ARUP, Ikemeleng Architects, ACSA

Exhibit 2.8 Land Uses Zoned near ORTIA, Ekurhuleni Region A



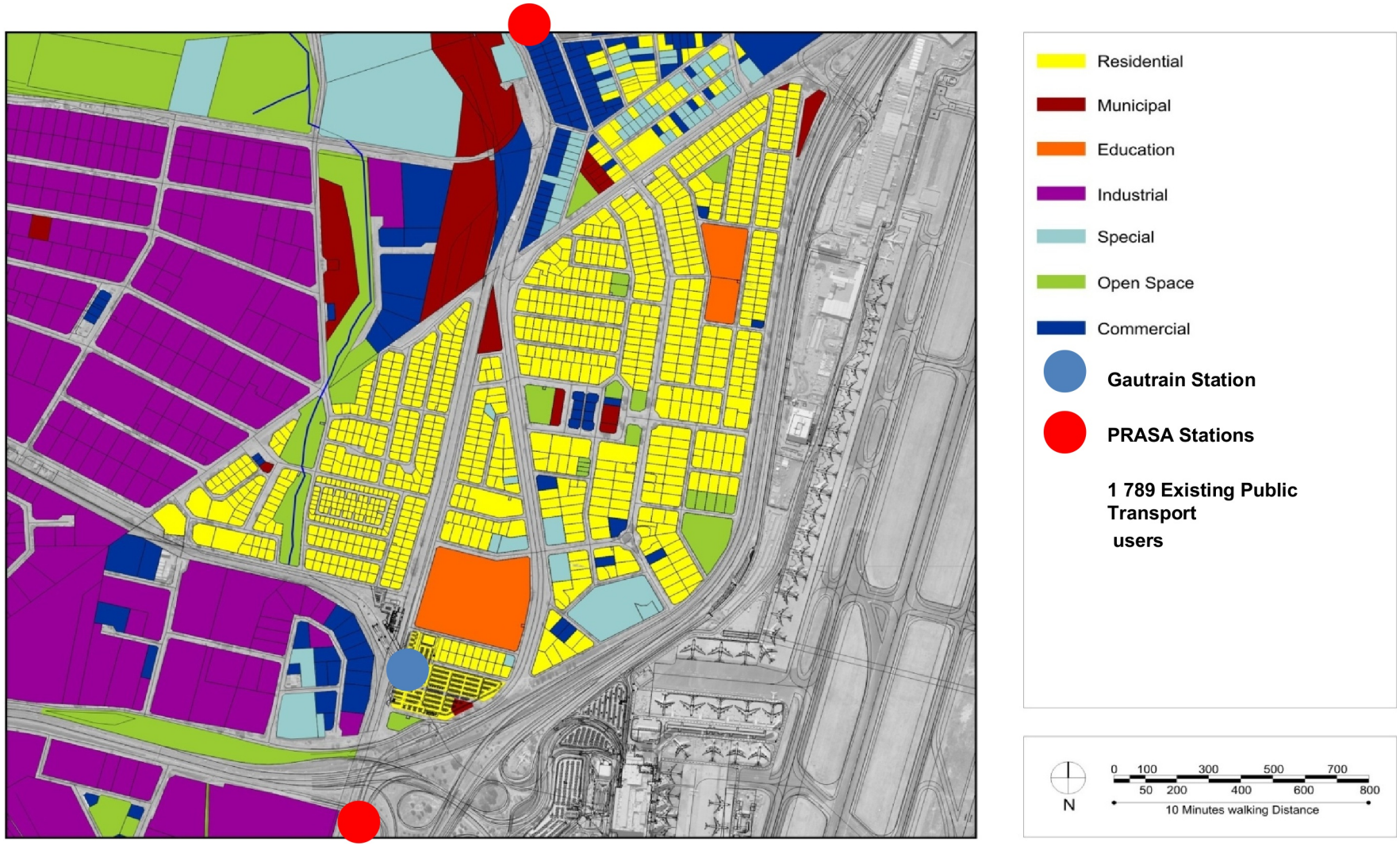
Source: Regional Spatial Development Feramework for Ekurhuleni, Region A, Status Quo Report, Draft Feb. 2012 (Metroplan)

Exhibit 2.9. Rhodesfield Redevelopment Study Area



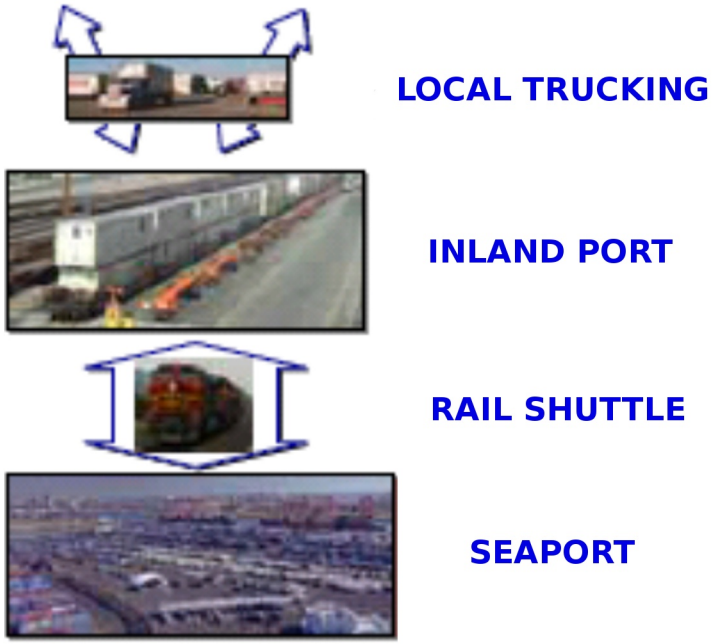
Source: Demacon Market Studies.

Exhibit 2.10. Status Quo Land-use in Rhodesfield



Source GAPP/ARUP/V&L

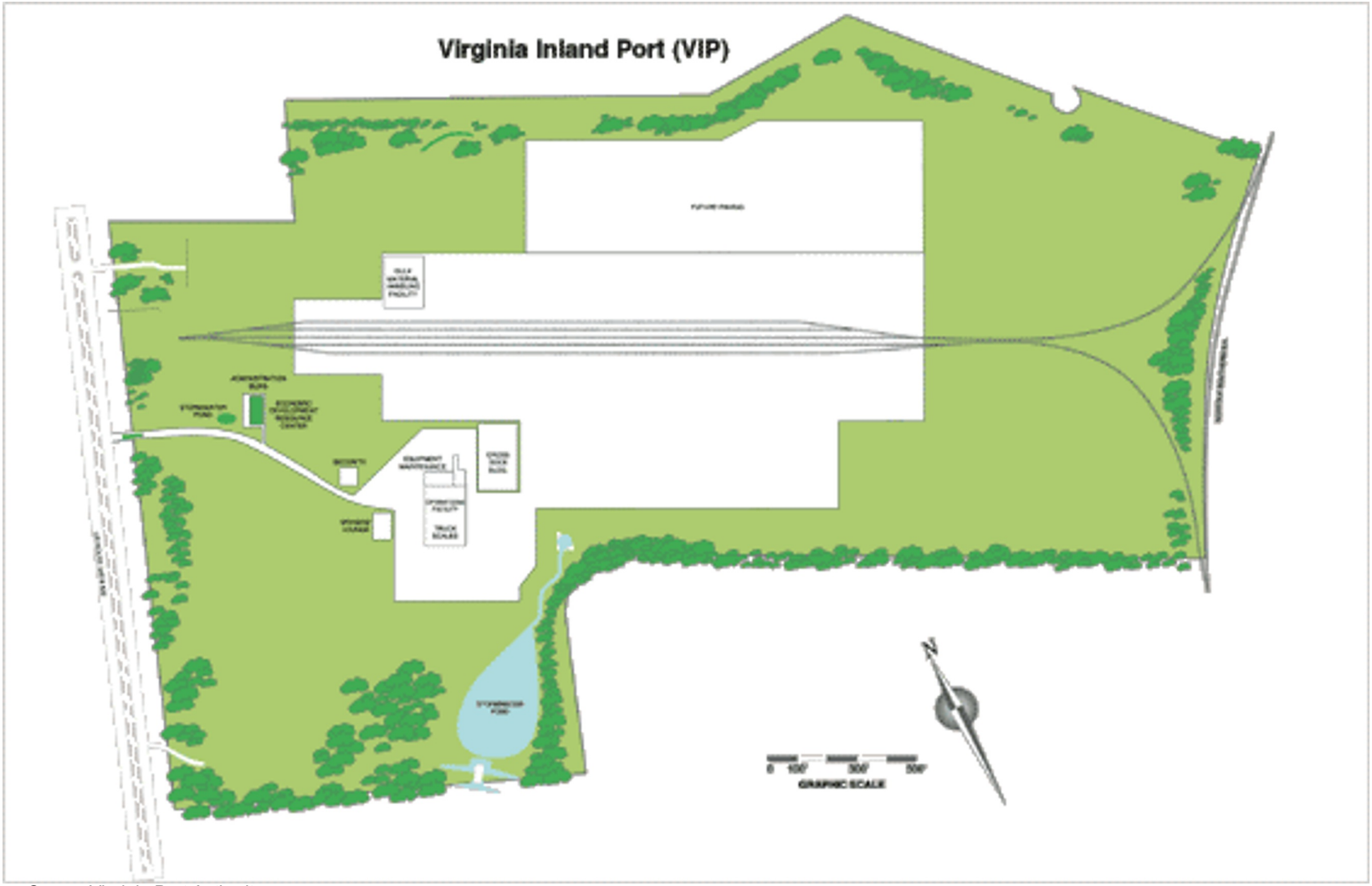
Exhibit 2.11. Basic Inland Port Functions



- Air cargo consolidation
- Transloading & FTZ
- LCV staging or truck parking
- Container depot & empty reuse
- Agile port containers sorting

Source: Southern California Association of Governments

Exhibit 2.12. Virginia Inland Port Layout



Source Virginia Port Authority

Exhibit 2.13. Schematic Layout of Inter-modal Transfer Point

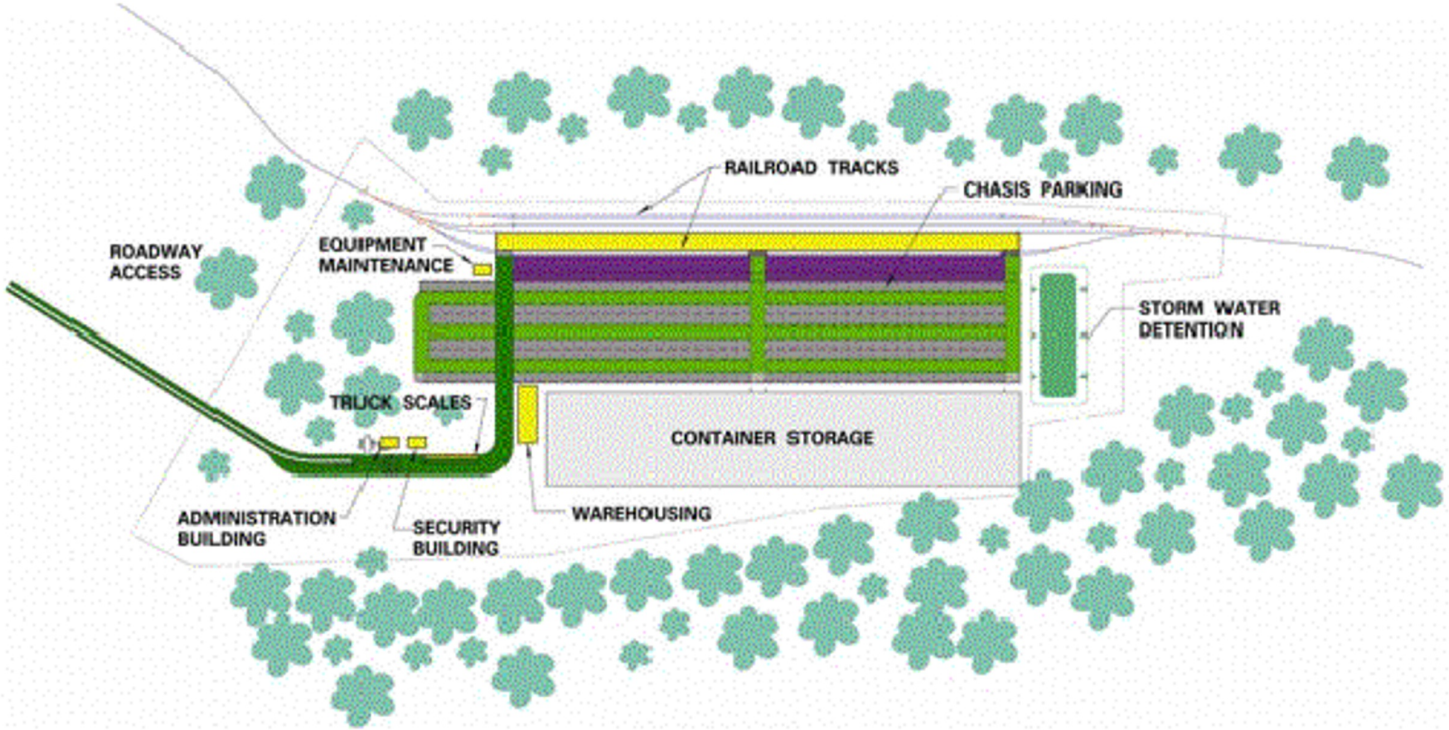
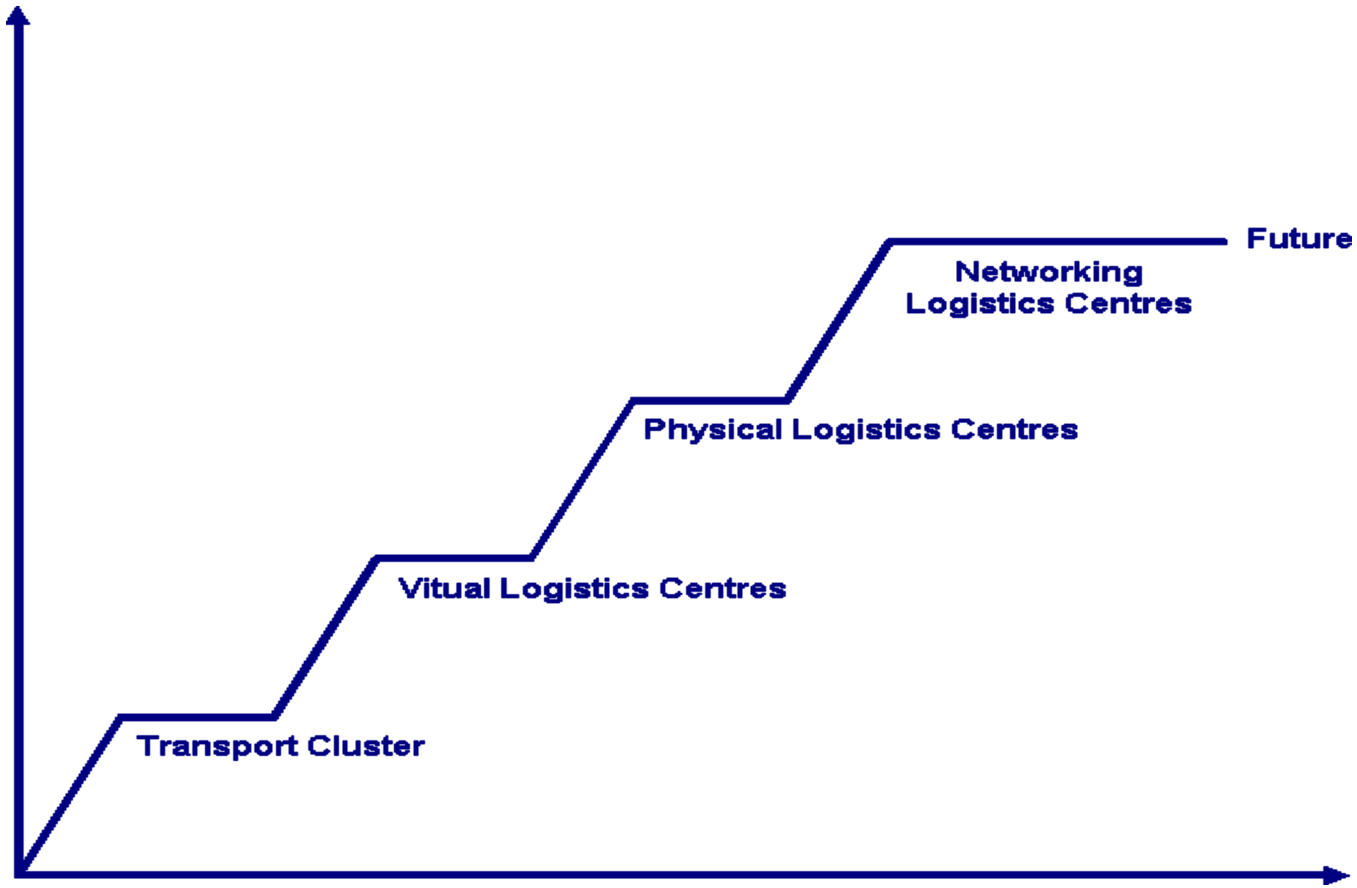


Exhibit 2.14. Possible Site to be Examined for Ekurhuleni Intermodal Facility near Airport

Source: Google Maps

Exhibit 2.15. Stages in Logistics Villages Growth



Source: Lars Bentzen (2004) "Best Practices on Logistics Centres," Final NeLoC Conference, Turku, 15 January

Exhibit 2.16. Summary of Logistics Village Characteristics and Services

PHYSICAL CHARACTERISTICS

- Size – Minimum of 125 contiguous acres; most are larger
- General Location – In or near metropolitan area, but not close to residential areas
- Access – Excellent access by road, possibly with rail connections; secure with controlled access
- Proximity – Direct access or proximity to intermodal facilities, ports and waterfront, and/or airport operations
- Design - Planned layout with amenities and landscaping
- Buildings – State-of-the-art facilities with offices, advanced communications and information technology infrastructure; size may vary, but typically smaller than traditional warehouses

CORE ON-SITE ACTIVITIES

A combination of:

- Integrated distribution
- Smart warehousing/specialized warehousing (e.g., refrigerated)
- Value added production or processing
- Intermodal operations
- Logistics
- Customs operations with Foreign Trade Zone status

CORE ON-SITE SERVICES

- Security
- Maintenance and repair of buildings and grounds
- Office space
- Meeting rooms/conference center or space
- Eating facilities – restaurant, cafeteria
- Business services – banking, mail, overnight delivery
- Public transportation and internal transit

ADDITIONAL SERVICES AND AMENITIES

- Vehicle service, repair, or parts facility
- Employment agency/temporary employment firm
- Hotel/motel/truck stop for drivers
- Training facility
- Hotel/conference facility for management

OWNERSHIP AND MANAGEMENT

- Ownership may be largely public or public/private.
- Management is generally in the hands of one entity, whether it is the owner or a contractor.

Source: Adapted from Weisbrod et al.

Exhibit 2.17. Transportation Linkages between a ORTIA Air Logistics Hub and Domestic and International Cargo Network

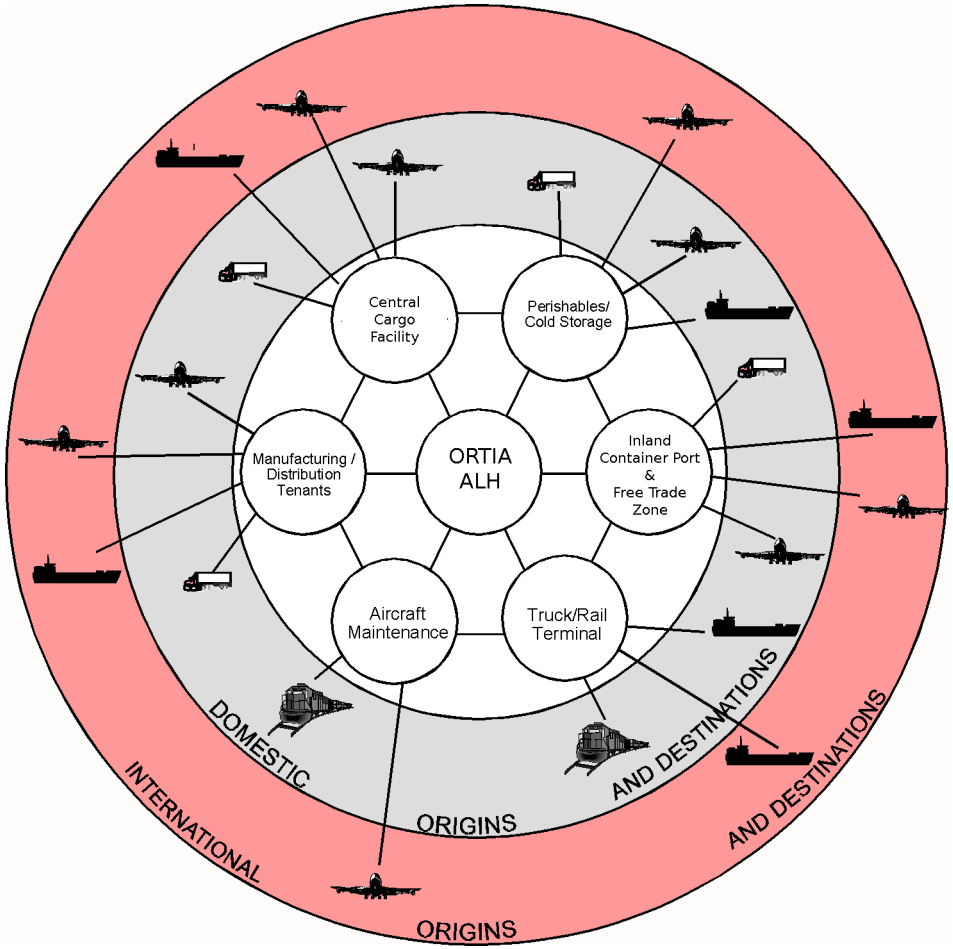
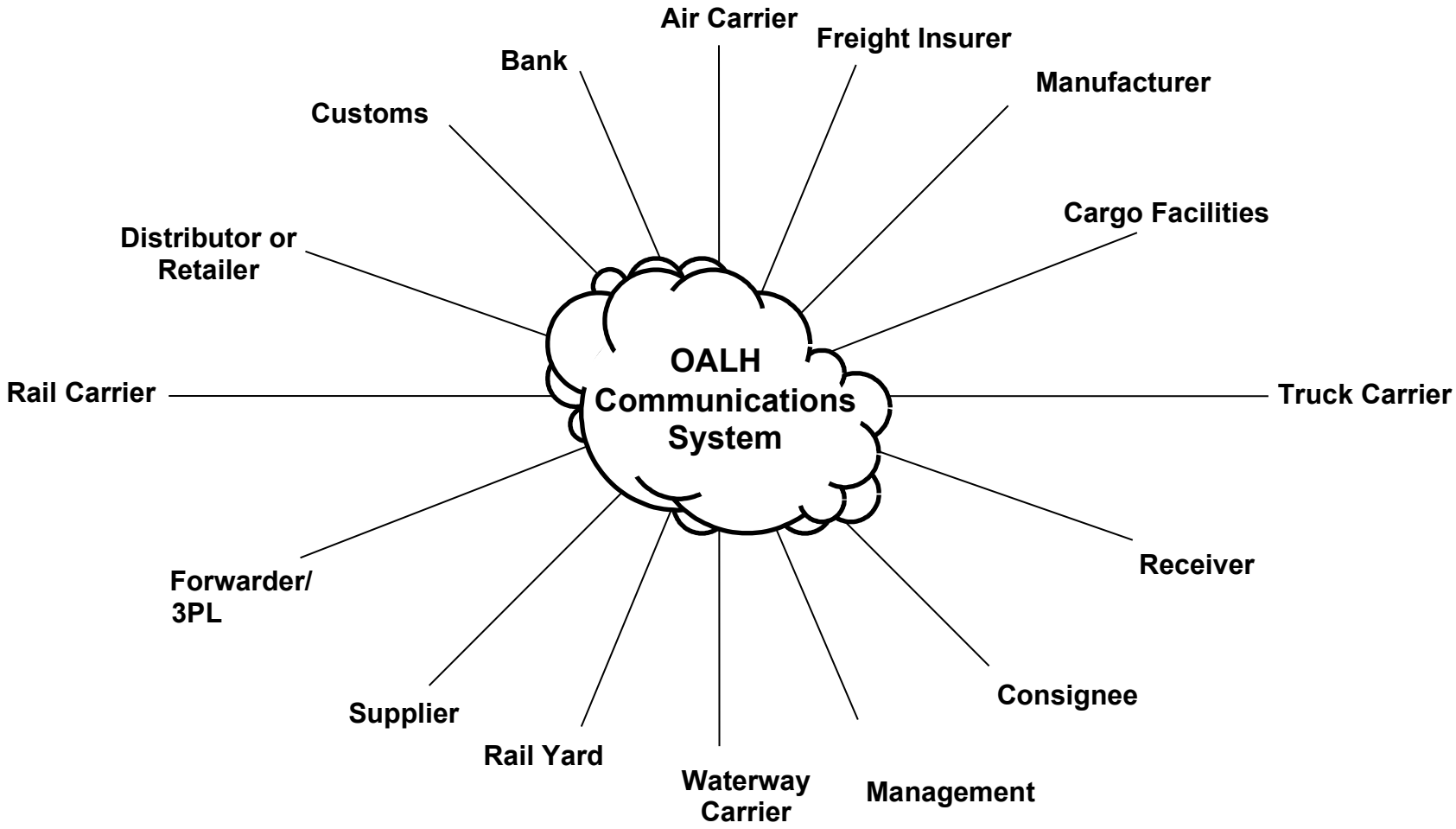


Exhibit 2.18. Overview of ORTIA Air Logistics Hub Communications System



Chapter 3

Ekurhuleni Aerotropolis Business Plan Guidelines

3.1 Creating a Competitive Business Environment at and around ORTIA

In Chapter 1, I described how speed, agility and connectivity have become 21st century competitive priorities for business and industry. The ability of Ekurhuleni companies to respond rapidly and flexibly to market opportunities will depend not only on expanding ORTIA's internal infrastructure and domestic and international flights, but also on the creation of the external business environment that makes their commercial practices successful. Exhibit 3.1 identifies the key business resource needs for a competitive industrial and commercial environment for the Ekurhuleni Aerotropolis and greater Gauteng Province with an emphasis on logistics.

This logistics environment encompasses much of the hard infrastructure and facilities described in the prior chapter as well as the commercial and knowledge support that makes up much of the "soft" infrastructure. Both hard and soft infrastructure represent important external business resources that must be synergized if more high-tech and other new economy firms are to be attracted and more efficient economic development is to occur in the Ekurhuleni

Aerotropolis. These external business resource needs are elaborated below, with a goal of attracting firms and improving land values by making ORTIA and its surrounding area the fastest, most agile location in Africa to conduct business. While I will focus on developing fast-cycle logistics as a primary means to attract modern manufacturing and higher-value goods-processing firms (an explicit goal of Ekurhuleni), I will also give considerable attention to attracting higher-value service sector firms to ORTIA's Airport City and the Ekurhuleni Aerotropolis.

3.2 Business Resource Needs

Making ORTIA and the broader Ekurhuleni Aerotropolis a magnet for higher-value, time-critical business and industry will require the integration of multimodal transportation, advanced telecommunications, commercial support, and knowledge support. The reasons may be summarized as follows.

3.2.1 Multimodal Transportation

First, modern logistics processes demand integrated multimodal transportation systems for efficient sourcing and distribution of parts, components and manufactured products. Seamlessly connected intermodal systems optimize 21st

century logistics and supply chain practices. Manufacturing inputs and outputs must flow among geographically dispersed firms in a fast, flexible and synchronized fashion. Air cargo facilities that are integrated closely with efficient highways and railways are needed to support the development and commercial practices of logistics villages, industrial parks, high-tech complexes, agribusiness firms, distribution centers, and to more efficiently link them to their sourcing, production and customer networks. This holds for perishables distribution, as well.

For example, the ability of restaurants, hotels, and supermarkets throughout the Gauteng Province to get high value fresh produce, fresh-cut flowers or fresh fish from distant markets quickly and reliably requires cool-chain facilities and temperature-controlled cross-docking facilities that link provincial surface transport with ORTIA's aircraft servicing national and overseas locations. Similarly, high-tech manufacturers require cross-docking facilities that bring parts, components, and semifinished goods efficiently to Ekurhuleni Aerotropolis production sites and facilitate the rapid shipment of assembled products to customers nationally and globally.

Thus, the business planning principle to be understood is that in today's networked goods economy, the firm is no longer the effective competing unit. Rather it is supply chain and the extended enterprise where the cost, quality, productivity, and profits of the firm is at least as much dependent on the cost,

quality, and delivery of its suppliers and downstream distributors as it is on internal management and operations of the firm itself. This is why multimodality has taken on such heightened business support importance in the 21st century.

3.2.2 Advanced Telecommunications

Second, the Ekurhuleni Aerotropolis requires an advanced telecommunications and electronic data interchange (EDI) network (as described in the previous chapter) to obtain information on markets and orders, trace, track and manage materials and inventory, and control movements of goods to customers. Such a network is also essential to attracting more sophisticated third-party logistics (3PL) providers and 4PLs (managers and integrators of 3PLs) to the Ekurhuleni Aerotropolis that will provide state-of-the-art logistics support to ORTIA users and Ekurhuleni firms.

According to the Georgia Institute of Technology 2004 global survey of manufacturers and logistics providers, third party logistics firms are used by nearly 90 percent of larger manufacturers to manage their outbound transportation, including the selection of airports and airlines. The survey also showed that 3PLs now regularly use web-enabled and other advanced telecommunications in meeting manufacturer's needs for supply chain ordering and inventory control, shipment tracing and tracking, customs clearance and

warehouse management. Similarly, electronic data interchange (EDI) is used by 3PLs for route optimization, fleet management, order fulfillment, customs brokerage, duty and tax payments and even factoring (inventory and trade financing). New e-freight practices by air cargo carriers and automated customs practices also heavily rely on advanced EDI systems.

The entire Ekurhuleni Aerotropolis telecommunications system should feature information technologies served by fiber optics loops, RFID, Wi-Fi, Wi-WAN (wide area wireless networks), and GPS satellite linkages that assist 3PLs and connect companies in the airport area and throughout the greater Gauteng Province to their suppliers and customers and to their own branches, offices, and partners throughout South Africa and the world.

A teleport with advanced information and telecommunications management systems should serve ORTIA's and customer premise equipment (including rapid worldwide communication, EDI systems, business to business (B2B) exchanges, and new-generation video conferencing equipment, such as Cisco's TelePresence) supported by communications satellites, fiber-optics, and high-speed digital networks. Operations (manufacturing process) research is showing that the telecommunications and information technology infrastructure external to a firm now heavily influences the effectiveness and efficiency of internal firm processes.

As international air commerce grows at and around ORTIA, this telecommunications system must also support even faster express customs clearance and more efficient trade data processing. The value-adding logistics special economic zone at ORTIA and cargo village for Ekurhuleni described in the last chapter could be used as a laboratory for expedited customs clearance procedures and electronic data interchange to achieve high-speed, barrier-free international flows of agricultural products, parts and components, and manufactured goods as well as a one-stop (single-window) trade data and information shop. Through joint determination with South African Customs of appropriate technology, procedures, and staffing levels (and in partnership with participating private sector firms), ORTIA can take the lead in creating the most efficient customs clearance system—24 hours a day, 7 days a week.

Instrumental to the success of ORTIA cargo development and Ekurhuleni/Gauteng's goods-processing firms it serves, will be speed and agility in moving high value to weight products to and from ORTIA throughout its surrounding Ekurhuleni Aerotropolis and far beyond. Much of this will rest on its advanced telecommunications systems for tracing, tracking and control of product movements.

3.2.3 Commercial Support

Third, the Ekurhuleni Aerotropolis business environment requires 21st century commercial support services. Since many globally-linked manufacturers, assemblers, and distributors must have access to Free Trade Zones it is highly recommended that the Ekurhuleni Aerotropolis have a number of these, at least one of which should be the value-adding logistics special economic zone described in Chapter 2 at ORTIA. Many Ekurhuleni Aerotropolis future firms will also require bonded warehouses at and near the airport, as well as financial institutions, marketing, sales and employment agencies, legal services, and trade and exhibition centers.

As noted above, expedited customs procedures are required to streamline and accelerate the import of raw materials, parts and components and the export of finished goods. One-stop (single-window) government service centers (combining federal and local agency requirements) are likewise necessary to expeditiously provide foreign investors with all required licenses, permits, and investment promotion privileges. Trade and exhibition facilities are needed to display and market products of South Africa's and foreign firms.

Visiting executives to the Ekurhuleni Aerotropolis will require four- and five-star business-friendly hotels with meeting rooms, high-speed data-ports and concierge business services conveniently located near the airport. In addition, the

ability to attract professional managers and highly-skilled younger workers to the aerotropolis will require quality residential complexes and a full array of community amenities including upscale shopping and fine restaurants, nightlife, recreational, and cultural facilities, as was proposed in the prior chapter for Rhodesfield. Surrounding or integrated higher-end shopping, restaurants, nightlife, and leisure facilities should also be developed near clusters of four-star hotels in the Ekurhuleni Aerotropolis as a tourist magnet. As high-tech industries are drawn to the Ekurhuleni Aerotropolis, such nearby amenities may also be critical to attracting and holding a good portion of younger professionals and other knowledge workers employed by such industries. These amenities will reinforce ORTIA's Airport City attractiveness to white-collar workers, as well as Ekurhuleni's attractiveness.

3.2.4 Knowledge Support

Fourth, many high-tech and business service industries must be located near or have ready access to knowledge resources that can generate or stimulate innovation and provide a reliable source of skilled workers and managers. The Gauteng Province is well-endowed with excellent universities on which businesses depend and which produce highly educated professionals, many with superb managerial or research skills. With its adjacency to ORTIA, Ekurhuleni is

particularly situated to attract international consultancy firms and tech-transfer organizations that help commercialize technology, develop new products, and service national and foreign firms more effectively. Marketing, international banking, auditing and other aviation-intensive business services provide an additional knowledge resource base and are gravitating to airport areas.

Such knowledge resources currently evolving in the Gauteng Province have proven to be a strong asset in attracting "new economy" manufacturing firms in aviation-intensive business sectors such as microelectronics, pharmaceuticals, aerospace components, and medical devices. For firm recruitment and support, an Ekurhuleni Aerotropolis distance education and training facility drawing on the airport area's improving telecommunications network could provide real-time audio, video and tactile worker training on-site (and, via distributed education and training, to facilities throughout the Gauteng Province) from education and training centers in headquarter firm locations around the world.

3.3 Further Enhancing the Aerotropolis Business Environment

Improving strategic and operational coordination is likely the most important step towards creating a competitive business environment in the Ekurhuleni Aerotropolis. To date, it appears that planning for ORTIA and its commercial

precincts may have proceeded largely without close coordination with Ekurhuleni planners and other stakeholders including the real estate development community. Because the fates of ORTIA, its Airport City, and the Ekurhuleni Aerotropolis are inextricably interwoven, such coordination is essential. Regular strategic consultations are therefore needed between ACSA, appropriate government officials and planner in Ekurhuleni and Gauteng, and the commercial real estate development community. As appropriate, SAA and other airlines might be invited to attend selected meetings.

These regular consultations are critical to information exchange and mutually reinforcing coordinated actions benefiting the Ekurhuleni Aerotropolis and its aviation-enabled sectors. For example, the ability of hotels to absorb the projected number of guests as they come on-line at ORTIA and Ekurhuleni should be routinely checked. If road congestion in a certain areas cannot be eliminated through increased construction, perhaps consultations could lead to better demand management. Airlines might express commitments to grow operations—or not—at ORTIA, guiding the construction and growth phases of its Airport City, IDZ, and new passenger and cargo terminal commercial functions, as well as Ekurhuleni commercial support facilities outside the airport fence.

The consultations are also important to deciding upon actions and adjudicating interests in order to allow the Ekurhuleni Aerotropolis to capture

the highest value-added activities possible. This would also include the recruitment of business and industries for concentrated investment and their development around the airport and along its major connecting highway corridors, to be addressed in greater detail later in this chapter.

All business plans must begin with an analysis of needs (demand). Little analysis of demand was found in the ORTIA Airport City and Ekurhuleni Aerotropolis Status Quo documents I reviewed. Later in this chapter, I will therefore also provide guidelines of what is required to support ACSA and Ekurhuleni investment decisions regarding Airport City and Aerotropolis facilities of various types.

Operational governance—the coordination of the daily operations of the various actors along the value chain—to maximize the performance of the Ekurhuleni Aerotropolis and Gauteng's greater economy is likewise critical. The airport-airline-ground transportation linkages discussed in Chapter 2 play a central role in increasing the operational efficiency of an air-enabled economy. So do business processes and their costs which I shall address shortly, as well.

Improving coordination will entail developing operational and strategic management information systems supporting a process of continuous improvement and periodic market repositioning. Systematic data gathering through consultation groups and reporting performance data for the entire air-

enabled complex to higher-level managers needs to be instituted. Without adequate information, responsible decisions are difficult to make.

3.4 Functional Capabilities Required

I have already summarized the business resource needs for aerotropolis success. In this section, I want to stress the importance of skills development. Acquiring and developing appropriate skilled labor is pivotal to moving up the value chain of any advanced business sector. Labor costs—not just for production workers but increasingly for professionals—remain central in competing for and growing such sectors. Labor costs can reach 80 percent or more of business expenses, even in some capital-intensive industries. In fact, relatively small differences in labor costs can have a significant impact on firm and national competitiveness. Contrary to conventional wisdom, knowledge-based firms are actually depending more and more upon accumulating cost-effective organized expert skills. Foreign expertise tends to be very expensive so local (South African native) skills development is essential.

Firms in growing economies like South Africa's typically have the largest challenges obtaining and developing their own mid-level "techno-structure" and "middle line" managers. These can be seen in the schema presented in

Exhibit 3.2. This is one aspect of the competitiveness frontier critical to Ekurhuleni's and South Africa's future.

Considerable research has shown that the absence of adequate mid-level management and technical skills hinders the ascent of emerging economies up the value chain. While Gauteng province's fine universities produce many skilled professionals, my discussion with multinational exporting firm executives suggest that there are serious gaps in the logistics skills sector. Developing and growing a qualified Ekurhuleni logistics labor force could yield a significant advantage for future Aerotropolis firms in time-critical goods-handling industries, increasing operational efficiency and thereby attracting additional aviation-oriented export businesses to the Ekurhuleni Aerotropolis. In the beginning, some of the more advanced Ekurhuleni enterprises may find that they need to "buy" rather than "make" (that is, they need to hire foreign logisticians) to meet their shorter-term technical labor needs in the air logistics and aviation-enabled sectors until the long-term indigenous (local) labor situation is upgraded.

Similar human limitations raise business costs and negatively affect the attraction of international freight forwarders and third-party logistics providers which are critical to driving air cargo volumes as ORTIA tenants as users. Multinational freight forwarder and 3PL firms have been establishing themselves in the Ekurhuleni area to take advantage of growing trade

opportunities. To repeat, it is essential that local labor meet the longer-term skill needs of these firms if they are to be cost competitive against other locations on the African continent.

Numerous studies have documented that a nation's and metropolitan region's logistics costs and overall logistics performance will affect the location decisions of firms that process goods, especially those firms involved in international trade. This, no doubt, has major implications for goods processing and logistics firms that might locate in the Ekurhuleni Aerotropolis in the future, not only affecting future commercial real estate development and jobs but also ORTIA's cargo volumes.

The point I wish to highlight is that the broader logistics environment in which the Ekurhuleni Aerotropolis development is based will greatly influence development success. Therefore, ACSA, Ekurhuleni and Gauteng Province officials need to work closely with logistics and other goods-processing firms to do all it can to boost local labor force skills as well as convince South African government leaders to lower logistics costs and improve logistics performance. These are critical business resource needs not just for companies, but for the entire nation to compete.

3.5 Electronic Data Interchange (EDI) and IT System Guidelines

One significant way in which logistics costs have been reduced while improving logistics performance is through electronic protocols. This is because a substantial portion of the delays to trade are not physical in nature—they are administrative. The emerging frontier in international logistics is reducing administrative trade frictions. Moreover, detailed information about shipments: their origins, destinations, locations, delivery dates, and the like are needed to manage fast-cycle logistics. These require management procedures and structures that are often embodied in information technology infrastructure.

The relevant information itself is often coded into particular electronic data interchange protocols, some of which are proprietary. Others are shared. Coordinating and accommodating these protocols is a major IT design challenge. In the next section, I will discuss business planning guidelines in terms of information technology needs with an emphasis on logistics IT, summarize the progress of the World Customs Organization "single window" and of IATA's e-freight initiatives, and note specific IT resources that will improve logistics processes to facilitate ORTIA cargo and, thus, Ekurhuleni Aerotropolis development.

3.6 Current IT initiatives

To provide this strategic guidance, I review two closely related IT initiatives oriented towards facilitating air cargo. IATA's e-freight project builds on the World Customs Organization's single-window program to simplify import and export procedures. Collectively, these two initiatives promise to yield network benefits for international air trade. That is, the benefits increase disproportionately as a common system is adopted. The main issues now appear to be political: convincing the South African government and their Customs employees who sometimes rely disproportionately on border controls as a source of revenue to reform procedures while persuading logistics firms and airlines which have sometimes made substantial investments in their own IT systems to adopt a common protocol. In each case, an investment threshold needs to be overcome.

IATA's e-freight initiative, formerly known as the Global Cargo Paperless Environment project, is part of the organization's Simplifying the Business initiative. According to Giovanni Bisignani, IATA's former Director General and Chief Executive Officer, "Every cargo shipment travels with up to 38 documents." Business process re-engineering is complicated by the large number of organizations involved in air freight. IATA estimates that there are nearly 15,000 stakeholders, including 270 air carriers, 200 national customs

organizations, and over 10,000 freight forwarders, among others. Each of these has its own interests and legacy IT system investments.

IATA's aim is to have 23 locations and 40 major airports with live e-freight facilities by late this year. By mid-2013, it is aiming for 44 live locations which would account for 80 percent of all international air cargo. Fourteen documents had already been replaced by electronic messaging standards by 2010. IATA's initiative could replace over 20 international documents by the end 2012. The initiative aims to increase geographic breadth and administrative depth. IATA is also aiming for e-freight implementation in the top five domestic markets by mid-2012.

IATA estimates that the program, when fully implemented, will save the air cargo industry $4.9 billion annually by reducing transfer time by 24 hours, by increasing document accuracy and eliminating manual errors, and improving shipment visibility for on-line tracking and tracing. The e-freight initiative has been estimated to eliminate more than 7,800 tons of paper documents annually. Airlines, shippers, freight forwarders, 3Pls, ground handling agents, and customs authorities all need to be involved.

It is my understanding that improved Customs clearance processes at ORTIA is a major ACSA goal. However, the success of the e-freight initiative depends critically on broader government reforms (e.g., reducing the number of

documents that must be signed and processed) and cooperation of the private sector.

Apropos the latter, let me note that resistance to Customs reform often stems as much from private-sector shippers as from government bureaucrats. Importers and exporters sometimes represent products somewhat differently to the various government offices and to airlines and freight forwarders. Usually, tax avoidance is the issue but other reasons crop up.

One way to address this is to enforce the WCO single-window program. A single window offers little opportunity for multiple representations. More importantly, e-freight software needs to conform to existing business process software. Border crossing procedures may often be a large impediment to international trade, but they are generally a minor factor in the value chain. Many logistics firms are constrained by client demands for shipment visibility to use systems compatible with client software. In some cases, therefore, investment in e-freight software imposes a burden without commensurate benefits. The diffusion of e-enabled trade software depends critically on conforming to larger business process and software needs.

ORTIA, I believe, is currently utilizing IATA's e-freight and WCO single-window programs. It should be if it is not. A related system that I like is the ASYCUD system which was developed and is regularly updated by the UNCTAD (United Nations Conference on Trade and Development). I

understand that this system is also in place at ORTIA and has been used by South Africa Customs.

3.6.1 Operating a ORTIA Airport Free Trade Zone

A key business resource for reducing logistics costs for value-adding exporters in the Aerotropolis model is a Free Trade Zone (FTZ). In Chapter 2, I discussed how the IDZ in ORTIA's northern precinct could be developed as a potential value-adding logistics and aviation-oriented Special Economic Zone. Free Trade Zones (sometimes referred to as special economic zones or export processing zones) have proven to be effective tools for attracting domestic and foreign investment , job creation, and trade promotion. They are designed cut tenant business costs, reduce bureaucracy, and speed the movement of imports and exports, thereby promoting firm competitiveness and thus encourage them to set up and/or expand their operations in the country. In ORTIA's case, my recommended value-adding logistics SEZ would likely grow cargo substantially.

These zones are also important components of intermodal cargo villages as described in Chapter 2. Thus, what follows is equally important to developing Special Economic Zones in Ekurhuleni and Gauteng. New South African legislation, in fact, is moving ahead to implement SEZ's in a much broader basis.

The zones consist of specified areas (usually fenced) within which value is added to goods via manufacturing, assembly, disassembly, sorting, labeling, testing, picking, packing, breaking bulk, grading, sequencing, consolidation or other forms of product manipulation. Merchandise entering and exiting the zone is provided tax and duty privileges as stipulated by federal laws and their flows accelerated by not having to go through the traditional Customs declaration and inspection process.

Under typical zone operations, formal Customs entry procedure and payment of duties are not required on imported merchandise unless and until it leaves the zone for domestic consumption, in which case the importer normally has the choice of paying duties on either the original imported materials, components and parts, or on the finished products. If the imported materials or finished products are re-exported, no taxes or duties are paid. Domestic goods that are moved into the zone for export are typically considered exported upon entering the zone for purposes of excise tax rebates and drawback.

Zones are sponsored by qualified entities such as ACSA or 3PLs that may operate the facilities or may contract for their operation with public or private firms. In general, the FTZ operator has the following zonal responsibilities, some of which may be subcontracted.

- Strategic property management and acquisition
- Facility and land leasing to tenants;

- Maintaining shared physical infrastructure (road, utilities, etc)
- Safety and security and access within the zone
- X-ray screening of imports and exports
- Truck routing and docking services within the zone
- Truck holding and employee parking
- EDI systems to improve the speed and efficiency in customs clearance and taxation
- Finance and accounting for zone operations
- Marketing (nationally and internationally) and public relations
- Tenant recruitment and support services
- Interfaces with customs, revenue, and other government units

The FTZ operator is also frequently involved in the inside and outside the fence tracking of cargo movements, cargo locations, cargo status as well as tracking the value-added activities occurring within the zone. Regarding the latter, the operator monitors cargo input to the value-added process and output from the process as required for reports to federal customs and revenue agencies.

To accomplish all the above, the FTZ operator must provide both "hard" and "soft" services. Hard services ensure that all FTZ facility systems are working efficiently, reliably, safely, and legally. Soft services ensure environmental cleanliness and high performance levels of services by monitoring the work of subcontractors and the operators' own employees via general supervision and through feedback from FTZ tenants and users.

A typical zone provides leasable storage/distribution space to users in general warehouse-type buildings with access to multiple modes of transportation. Many FTZ's include an industrial park site with lots on which users can construct their own facilities.

The handling of imports and exports differs among FTZ's around the world. In many, the operator sets up a special facility within the zone where they monitor (and sometimes control) merchandise admissions, storage, transportation, removals, record keeping, manipulations, distribution, exhibition, and physical and procedural security in the zone as determined by federal laws and regulations. Some operate warehouses where in partnership with Customs they receive, inspect, store and distribute merchandise in a safe and sanitary manner.

In the US, the operator (often a private sector 3PL) is authorized to provide guards or contract for guard service to safeguard the merchandise and ensure the security of the zone. However, in the U.S., the operator at its liability, may allow the zone importer or owner of the goods to store, safeguard, or otherwise maintain or handle the goods and the inventory records pertaining to them. Information is provided by the tenant to the operator and customs on a weekly basis on all merchandise flows to and from its manufacturing facility. This allows 24/7 operation by the manufacturer in a fast and flexible fashion,

unencumbered by federal customs employee work hours and weekends in which customs or other government agencies may not operate.

According to the head of the Association of Economic Processing Zones, in most FTZ's around the world, the zone tenant (e.g., manufacturer) has the responsibility for goods coming into the zone (i.e., stored in its own building). In fact, the FTZ operators often do not want this responsibility for liability as well as cost reasons I will elaborate shortly. In some zones, the logistics and manufacturing facilities contain a bonded cage where the merchandise (e.g., parts, components) are received. Employees of the firm's facility count and do quality control, but it takes an official (either the FTZ operator or Customs official) to remove them. In such cases, the logistics firm manufacturer pays the operator or Customs officials for the hours of service desired, up to 24/7.

Throughout the U.S. and in much of Europe, Asia and the Middle East, there is a movement towards tenant control and responsibility for merchandise entering and leaving the zone, including all Customs documentation and taxes. This has been greatly facilitated by new open architecture software that allows data inputs on merchandise flows to be shared in real-time (instantaneously) with customs and the FTZ operator. Taxes and duties are paid within 14 days of filing weekly entries. Customs conducts thorough audits of zone firms every six months with duties and penalties paid on discrepancies. There are more frequent audits and physical inspections of firms having significant discrepancies. This

electronic weekly filing by the manufacturer substantially reduces paperwork while increasing speed and efficiencies of product movements, which are pivotal goals of FTZ's. Under modern FTZ operations, the onus is thus on the tenant firm for merchandise security and to make sure that it is fully in compliance with customs rules and regulations and that the tenant keeps its taxation and customs obligations current and accurate. This could prove to be a mutual benefit to both the tenant and ACSA at ORTIA and the tenant and Ekurhuleni in its future SEZ-based cargo villages.

3.7 Commercial and Service facilities

My business plan guidelines have thus far focused primarily on developing ORTIA and its surrounding area as a world-class multimodal air logistics complex. The reason is that experience has shown that this strategy has proven to be the most important initial driver of Aerotropolis development success.

In this section I focus primarily on commercial and service facilities that contribute to Airport City and Aerotropolis success, emphasizing factors underlying facility demand. In the next section I will provide guidelines for determining facility demand. Suffice it to say here that commercial facility demand is driven by location need of potential tenants. These, in turn, are determined largely by firm cost factors. Locations decisions are built on multiple

considerations including the costs of surface transportation (and thus labor travel costs and/or the willingness of shoppers to travel to a destination), land costs, the competition for the most accessible land, location status, and, or course, airport connectivity. Below I briefly examine various types of commercial and service facilities in the context of Airport City and Ekurhuleni Aerotropolis demand factors.

3.7.1 Retail Space

Airport and airport-area retail has various forms and demand factors associated with it. Retail space serving passengers is generally limited to the terminal. The demand for retail space depends upon the level of air traffic, the demography of passengers, and airport policy. Some airport operators are willing to sacrifice financial returns to boost passenger service through non-profit making facilities that improve the passenger experience but are located in areas that could generate solid revenues. Typically, though, profit-making activities win extra space. For example, one U.S. airport operator opens additional space when sales per square foot per month hit a target level in any retail outlet. Sales per square foot serve as a management indicator that customers may not be adequately served.

Some airports have been able to develop significant retail outside the security zone. Others have not. Rail and bus access appears to be a factor in developing retail outside the security zone. Retail space for non-travelers depends critically on the market catchment area and the ease of airport access. Minneapolis' huge Mall of America (located three miles from the airport terminal but connected by and automated people-mover) reportedly derives over ten percent of its sales from airport-based visitors. The airport is a major Delta hub for trans-Pacific flights which attract a large number of passengers with long layover times. This mega-mall also attracts "retail tourists" who fly in from Asia and across the U.S. to shop, dine, and even sleep in the mall's hotels.

Proposed future light rail connections between ORTIA and the East Road Mall might serve a similar function as could future light rail connections to other commercial nodes in the Ekurhuleni Aerotropolis. And, of course, the Gautrain connection to Sandton and Mandela Square will draw "retail tourists."

Duty-free sales inside and outside the terminal depend critically on passenger demography and the alternatives open to travelers. Dubai duty-free has more than US$1.4 billion in sales annually since many transit travelers from Africa and Asia do not have good shopping facilities in their home cities. The proposed bulk duty free zone north of the western precinct along the R21 highway holds promise for Africans transiting at ORTIA, as well as international

shoppers and tourists. Ekurhuleni should explore how it can capitalize better on African passengers transiting at ORTIA, as well.

Direct factory outlets and big box retailers requiring large flat land parcels with sufficient parking have operated successfully serving mainly local non-travelers when the catchment area is sufficiently large. A key for the Ekurhuleni Aerotropolis retail success will thus be measuring appropriate catchment area demand which I will address in a following section.

3.7.2 Hotels

Demand for airport and airport-area hotels is likewise largely determined by volume of passenger traffic, especially business travelers and tourists. Upscale terminal-linked hotels (4- and 5-star) are becoming increasingly common and have generally been successful. Passengers and others value quick, walking terminal access and the combination of retail, food, and service amenities provided by the terminal. Many of the hotels serve as virtual corporate headquarters and business meeting locations for executives who fly in for the meeting with perhaps just one overnight stay.

For broader aerotropolis hotel development, there is typically a mix of 3- and 4-star hotels, often near intersections of the main airport highway corridor to the city. Airport hotel clusters develop in part because air travelers chose to

spend different amounts on accommodation and because they often have different needs. Unfortunately, the separate hotels are often dispersed requiring taxi, automobile or airport bus shuttle and often lack late night meal service, hotel business centers or entertainment amenities.

Locating several hotels in an integrated cluster would (1) simplify airport and central city ground transportation, (2) provide convenient access to a range of accommodations, and (3) create the economies of scale which would allow on-site restaurants, entertainment, and retail to emerge. Such services would be enhanced by easy highway access allowing the mixed-use hotel cluster to partially act as a neighborhood service center as it does near Zürich Airport. If such a complex were to be along a route to an extended airport parking area, it might eventually be served by an airport people-mover as is envisioned by ORTIA in its long-term commercial development plan. Moreover, the mixed-use cluster could eventually anchor airport area office development for businesses requiring convenient airport access but also desiring a range of commercial services not easily generated near airports. That is, the mixed-use hotel cluster might seed a secondary (off-airport) airport city in the Ekurhuleni Aerotropolis should the demand arise.

3.7.3 Conference and Exhibition Complexes

Conference and exhibition facilities tend to be most successful at and around large hub airports (e.g., Atlanta, Frankfurt, Hong Kong, O'Hare, and Schiphol). Some smaller airports such as Helsinki, Munich, Stockholm, and Oslo have developed successful conference and exhibition venues drawing on their centrality in a market region and air networks. With its Emperors Palace complex, Ekurhuleni has combined casino resort amenities with conference facilities for mutual reinforcement.

The attractiveness of the destination also seems to play a role, Hence, in the U.S., tourist cities and resorts such as Las Vegas, Orlando, and Miami enhance success. For aerotropolis development, competing conference and exhibition venues in the area can oversaturate the market. This is another reason why coordinated planning is imperative between ORTIA and Ekurhuleni for future commercial development.

In addition to sufficient air networks, surface transportation access plays an important role in airport area conference and exhibition success. This has been shown to be particularly the case in the exhibition areas near Atlanta's, Chicago O'Hare's, and Hong Kong's airports. With improved surface transportation planning described in Chapter 2, both Ekurhuleni and ORTIA conference and exhibition prospects will be enhanced.

3.7.4 Office Buildings

The signature headquarters buildings of based airlines often grace major airports but the offices of travel-intensive sectors such as producer services are often the most difficult segment of demand for most aerotropolises to capture. Office functions need to balance the costs of airport access for travelers with the costs of commuting costs of employees. In some cases, these considerations reinforce the attraction of airport areas but in many, they do not. With the exception of Schiphol and Frankfurt's AirRail Center (now The Squaire), which are both centered on regional passenger rail and highway linkages with good commuter access, most airports have difficulty in attracting office functions beyond those which are directly connected to the provision of air transportation. Some other airports have had moderate success. The Gautrain certainly enhances office development prospects at both Rhodesfield and ORTIA but with coordinated municipal rail and BRT added the prospects will be further enhanced.

Office development demand is highest along the main highway connecting the airport with the downtown. This is because of the dual accessibility this highway corridor provides to the city and the airport. As I noted in Chapter 2, this is why I believe more attention should be directed to office development cluster along the R24 corridor linking ORTIA with Johannesburg. As noted, this corridor has commercially evolved in a somewhat

haphazard fashion, with inappropriate uses interspersed with more appropriate aerotropolis uses. The R21 corridor towards Tshwane also holds office park potential as does the N12 corridor running east-west through Ekurhuleni linking Springs, Benoni, Boksburg and Bedgordview. The latter (N12) corridor, which is currently undeveloped, will serve ORTIA's midfield commercial precinct with the construction of road links and interchanges, making it potentially prime for future office development.

3.7.5 Services

The location determinants of services vary widely. Traveler services and some cargo-handling services are strongly attracted to airport locations and are among those types of businesses willing to pay a premium for airport proximity. The greater the degree to which the services depend upon air transport, the higher their likelihood of siting in a location with good airport accessibility. We are already seeing this along Ekurhuleni's highway corridors.

Many other services are attracted to airport areas primarily by the value proposition of land availability for cost. For the Ekurhuleni Aerotropolis, educational facilities (such as an aviation university or executive education) or quality medical tourism facilities can be good anchor tenants which attract other tenants and add prestige to the aerotropolis. In Hyderabad India, for example,

the GMR Group, developer of the Hyderabad Aerotropolis, recruited an international business school and major health provider to their aerotropolis, as much for stature in drawing other facilities as for real estate returns.

3.7.6 Recreational Areas

Recreational areas, such as nature preserves (without birds), and industrial functions can serve as good airport safety and noise buffer areas. The large parcels of land area sometimes available near airports has led to proposals for theme parks and green recreation but accessibility to the regional customer base remains an important determinant of success.

Terminal area recreation (game rooms) and cultural facilities are often located in zones which are not yet sufficiently attractive to support revenue-generating retail facilities. Travelers appear to value the rest afforded by cultural offerings. Some airports and airport areas offer community-oriented concerts and festivals. The aim appears to be generating good will, rather than revenues. Though, as noted in my comments on the future development of Rhodesfield, they can add to the dynamism and attractiveness of new urban centers

3.7.7 Real Estate Value-Proposition

The viability of aerotropolis real estate development depends critically on the value proposition offered to potential tenants. ACSA and Ekurhuleni officials must recognize that almost all potential tenants can choose alternative locations. Thus, price, quality, and the availability of alternatives throughout the region are important co-determinants of demand. For that reason aerotropolis demand forecasts need to be considered in the context of regional growth expectations and the competitiveness of the airport area as a location for specific facilities with respect to alternative opportunities within the region.

Projections of facility demand are the foundation of aerotropolis planning but history shows that forecasts often are inaccurate. Nevertheless, the process of forecasting demand generates important strategic insights which help determine the pace and nature of commercial real estate investment, maximizing financial returns. In the following sections I present the guidelines to be followed in assessing future facility demand, including forecasts, risk analysis and competitor analysis.

3.8 Analysis of Airport City and Aerotropolis Facility Demands

All ORTIA Airport City and Ekurhuleni Aerotropolis business and facility development plans should begin with an analysis of needs. Although documents I reviewed on ORTIA's commercial precincts and Rhodesfield in Ekurhuleni may be useful for visioning and initial planning, they are certainly inadequate to support investment decisions. Investments for the ORTIA Airport City precincts and Ekurhuleni Aerotropolis complexes envisioned would likely total in the many billions of U.S. dollars. Investing such an amount of funds on the basis of planners vision or air traffic forecasts with unclear methodologies and possible biases introduces the substantial risk of expensive mistakes and redevelopment (or withdrawal) later on.

For future investments in the ORTIA Airport City and Ekurhuleni Aerotropolis commercial complexes, higher-quality investment-grade information on facility demands will be needed by ACSA and private sector investors. More extensive and more detailed information would be valuable because it helps decrease capital costs by reducing uncertainty. Moreover, investment grade information—that is information based on known data, using validated methods, and identifying key assumptions – also helps increase investor commitment to the project and helps ACSA and Ekurhuleni planners

refine their offerings. Because it is so valuable, albeit expensive, investment grade information often warrants their high costs.

Credible measures of specific facility demands in Ekurhuleni and of ORTIA "capture rate" are needed. The documents I reviewed included preliminary estimates and forecasts derived primarily from passenger and cargo forecasts at ORTIA and some basic market and economic impact analyses. I could not find other methodologies used nor how economic conditions might alter them, either at the global, national, or local levels. As a consequence, should economic growth slow or accelerate, potential investors would have little idea of the degree to which particular investments might be affected. Since business cycles have such significant short-term effects, one of the critical challenges of financial and commercial real estate downturns is to have the information that could justify a strategy of "staying the course" during difficult times.

Credible, transparent demand projections not only decrease risk but also increase investor confidence thereby decreasing the probability of investor dropout and reducing capital costs. The dire consequence of weak or over-optimistic projections can be seen throughout the commercial real estate industry.

Another possible consequence of over-optimistic projections or those which do not elicit full confidence is the withdrawal of committed investment. The decision frequently appears to be a result of an inability to obtain adequate

finance. Such outcomes can occur as a direct result of changed lending decision rules but the bank financing decision is the point at which the adequacy of the demand analysis is usually seriously examined and evaluated. Since troubles with financing frequently are troubles with appropriate demand analysis, experience in the U.S. commercial real estate sector suggests that good, empirically validated projects usually secure funding.

This is because demand projections are a basic pillar of business planning. Unfortunately the projections, as I noted, are frequently wrong. No one can accurately predict the future but as the financial commitment escalates, the quality of information needs to follow suit. In addition to documenting the projection process, forecasters should provide a range of plausible demand trajectories so that investors and developers can assess the impact of projection errors on their revenues and costs.

Risk cannot be eliminated but it can be managed. Both ACSA and Ekurhuleni officials need to remember that well-developed plans do not necessarily imply investor commitment and investor commitment does not necessarily imply customer attraction. The best method of ensuring investor commitment, however, may be to improve faith in future demand. In the following section I offer guidelines for generating forecasts of future facility demands.

3.9 Guidelines for Generating Facility Demand Forecasts

I have noted that investment-grade commercial real estate demand forecasts are valuable but they can be quite costly to produce. In some situations, municipal authorities perform much of the work and the results of the process can be obtained, sometimes for a nominal cost. The municipal projections generally need to be supplemented by more detailed work. I describe the process of generating commercial real estate demand forecasts because Ekurhuleni Aerotropolis planners may need to either replicate or build on such work. An understanding of how the forecasts are made is also useful in understanding how sub-regional real estate capture rates may be affected by aerotropolis offerings, such as those planned for the Ekurhuleni Aerotropolis.

Projections are typically generated in several steps. The first step entails obtaining current and historical estimates of population and employment. The second step entails generating top-down estimates for the region and sub-regional areas. The final step requires developing small area estimates of households, population, and employment. These are generally developed from the bottom-up allocating the projected growth to specific locations on the basis of the relative attractiveness of particular locations for particular activities.

The process involves both systematic modeling and expert judgment. The smaller the area, the larger the judgment factor needed. Because the aerotropolis

district is not the only option for commercial and residential location, the process requires that the growth in the entire region be projected—although small area detail is not often required outside the aerotropolis district.

Government statistics are generally used for measuring current and past population and household counts. In the U.S. and other countries, the Census generates detailed small area data. Employment data are more troublesome as government statistics are not often reported for small areas. In the U.S., private databases, such as those provided by Dun and Bradstreet and InfoUSA, are often purchased and cross-checked by telephone interviews with the larger employers and by "windshield surveys" of commercial areas.

The sub-regional top-down forecasts begin with sector-specific nation-wide employment projections to estimate region-wide totals and sub-regional subtotals. The results guide the third-stage bottom-up process. Region-wide estimates are needed because smaller areas generally capture a share of regional growth.

Employment projections form the basis for projections because, population change is often substantially employment led. (In growing regions and districts, this is usually the case.) Sub-regional projections are often calibrated on the basis of a large number of geographic units in regions with roughly similar characteristics as the region of interest. In the case of one Kenan Institute project, approximately 225 sub-regional areas were used in the

calibration set. (In the U.S., counties are often used in the calibration but the results can be applied to county sub-divisions given a certain population size is attained.)

In the U.S., the forecasting process often rests on an extension of the Bureau of Labor Statistics' ten-year nation-wide projections of employment, tempered by the Census Bureau's projection of population by age and sex to control for the available labor supply. The process creates national profiles of industry-specific employment for several dozen industry groups tracked by national statistical agencies.

The national projections are used to create region-wide projections by first separating employment in to "economic base" (regional export) and "population-serving" sectors. Region-wide basic employment is then modeled as a fraction of national employment in each of the basic sectors. The evolution of the regional capture rate is then modeled on available data, reaching back as far as data availability allows, to predict the fraction of national employment that will be found in the region at critical points in the planning period (which is often 30 years in U.S. projects).

Having projected basic employment, population-serving employment is then estimated on the basis of past relationships between the different categories of employment. Region-wide population is forecast on the basis of the trend of

past relationships between basic and population-serving employment. Migration makes up for the possible labor shortfalls and overflows.

The region-wide employment (by sector) and population (by income band) totals are allocated among the sub-regions with the aid of equations which are calibrated by empirically examining historical values in the calibration set. The values for the variables are generally predicted in blocks according to their degree of independence from the population distribution within a region with the estimated values helping to predict the values in subsequent, more population dependent, blocks. Industrial activity variables are predicted first followed by producer services, households, and, finally, population-following employment, such as consumer services and retail. The sub-regional demand for commercial space is estimated from employment forecasts by applying a regional planning ration of building space per employee for each sector.

The prediction procedure can either be applied repeatedly for mid-length periods of about a decade or be targeted to the planning horizon, which is generally 25-30 years for infrastructure planning. Predictors are generally limited to readily available variables but many systematic unobserved influences on growth are believed to be incorporated in observable past growth trends. Geographically detailed information makes top-down projections possible for small areas but practitioners are often reluctant to apply the method to areas of less than 50 square miles or a population of less than 25,000. Aerotropolis

planning areas often meet or exceed the geographic cutoff but do not always meet the population threshold, leading to increased uncertainty in the projection process.

Four factors are typically found to recur in predicting commercial and residential real estate development: recent population gain, recent employment gain, development density (as a measure of the space available for further development), and share of upper-income households. Because aerotropolis developers sometimes wish to steer development in a new direction – towards the aerotropolis – special attention needs to be paid to seeding and/or jump-starting development in new locations.

The third stage of the process allocates the projected sub-regional growth to progressively smaller zones, based on regionally calibrated spatial development models and property parcel-based scores of developability. This stage of the projection process can entail considerable cost and may not be needed outside the aerotropolis district.

Site characteristics, such as presence in a flood plain, hilliness, and size of parcel, and situation characteristics, such as surface transportation access and the nature of surrounding development, are used in determining development potential. (In one North Carolina case, individual developed parcels are categorized into five residential categories [based on density] and eight employment categories using land use and building code descriptions in the tax

records. Not all local records include the needed detail.) Validation by local knowledge is needed at this stage.

Aggregate land development factors are sometimes modeled for relatively small spatial grids which are then aggregated to calculate small district attractiveness scores. Historical data is used to calculate development density. Existing development and available land acted as brakes on further growth.

In addition to the property parcel data and the population and employment data, the small area projection process entails the collection of data on existing and planned school locations and enrollments along with other population attractors. Additional data helps pinpoint employment location.

Sub-regional sectoral employment projections are generally collapsed into categories based on the nature of their land use and location behavior. For example, another North Carolina development projection study used (1) a broad category containing Manufacturing, Industrial, Warehousing, Telecommunications, Utilities, (2) Retail, (3) Highway Retail, (4) Low Traffic Service, (5) High Traffic Service, (6) Office and Government, (7) Banking, and (8) Education as employment land use categories. The population chasing employment is allocated to districts in the same proportion as population or purchasing power distribution. In the cases where there is insufficient space in a particular district for the forecasted employment growth, the additional employment was allocated to a neighboring district. Non-population chasing

employment is allocated among districts by a consensus discussion of the expert panels of available land and evolving location patterns.

This projection process is complex, expensive, and best adapted to incremental market-led development. That is, although in practice a significant amount of expert knowledge and contextual information are used, the projection process works best for steady, piecemeal growth. Empirical patterns are stylized, adapting experiences elsewhere. New developments, such as office parks along aerotropolis highway corridors, rely on the sub-regional projections to provide a first approximation of potential demand.

The success of such innovative land development relies first and foremost on a large (potential) unmet demand for space fueled by regional economic and population growth. Without growth, the need for new facilities is typically minimal. (There have been cases where initial air cargo service has been instrumental in tapping large under-employed labor pools, resulting in substantial new facility investments in the absence of significant population growth.)

Success also relies on the ability of the planned development to deliver value at a more than competitive price than the available alternatives. Even the most air-dependent businesses can be located many miles from the airport. Zappos, the huge U.S. shoe retailer which relies almost exclusively on UPS for retail sales, located its main distribution center 20 miles from UPS' Louisville

airport hub. Flextronics' laptop repair facility, which uses FedEx Express for nearly 100 percent of its supply and delivery is located nearly 10 heavily trafficked miles from Memphis airport. Although some are more constrained than others, all potential tenants have choices. The level of demand depends in part upon the price and quality of land, infrastructure, and facility offered.

Success further depends upon a viable growth-seeding strategy. Such strategies build on the development attraction potential of airports by providing an enhanced nucleus of employment attraction. London's Canary Wharf project may provide a good example of an innovative land development-seeding strategy which built on strong metropolitan property demand, labor force accessibility, and a scale of development able to provide the advantages of concentration to a space-starved sector. Although deemed a success today, its original developers went bankrupt.

Pricing policy is an important demand enhancer. The initial kernel of new developments often must offer exceptional value for money in order to induce pioneer tenants to assume the risks of a new location. Large scale real estate developments also frequently use a variation of the "shopping center" model to attract anchoring development. That is, the capture rate of an aerotropolis district can be affected by developer strategy. Within limits, demand can be induced., which will be a key ORTIA Airport City and Ekurhuleni Aerotropolis objective. Yet, there are always competitors.

3.10 Airport City and Aerotropolis Competitor Analysis

As ACSA and Ekurhuleni make its Airport City and Aerotropolis development plans, other actors within the Gauteng Province are not sitting idle. Local competitors can reduce the capture rate. Therefore, in addition to conducting appropriate facility demand analysis, both ACSA and Ekurhuleni officials need to explicitly recognize the possible impact of existing and potential competing sites in the greater Gauteng Province on facility demands and the returns to its investments. Each sector has its own dynamics but for some, such as leisure and commercial complexes, the largest local market or facility may capture the greatest share of growth. Even when capture is proportional, demand can be sufficiently diluted by competitors that profitability is impacted and service thresholds are not met.

The implication is not that particular investments should be avoided. As competition heats up, it may be nearly impossible to avoid direct challenges. ACSA and Ekurhuleni need to clearly acknowledge and plan for possible competitors within and even external to the Gauteng Province. Little intervention may be possible to counteract external competitors but a mechanism is needed to manage competition within the province to encourage timed development and ensure that local competitors do not split the market and thereby undermine success of all. This underscores the strong

recommendation made in Chapter 2 that ACSA, Ekurhuleni, and Gauteng planners regularly meet and approach commercial development in a coordinated fashion.

3.11 Risk Analysis

As argued in Chapter 1, ORTIA Airport City and Ekurhuleni Aerotropolis development is a long-term project requiring substantial investment but also offering significant rewards to its firms, users, investors, and the greater Gauteng Province. There are, however, considerable risks entailed. Improving business intelligence, especially information on demand, helps reduce the level of risk but it will not eliminate it. As has been seen over the past decade, unexpected economic shocks, related to security concerns, disease, fuel prices, and financial crises can reverberate through the aviation system with considerable impacts for all investors. The ongoing European economic crisis is one instance of such a shock.

The allocation of business risk can affect the behavior of investors, as recent events at demonstrate. It may be possible for ORTIA Airport City and Ekurhuleni Aerotropolis development to be speeded by reallocating risk, possibly by ACSA and the Ekurhuleni Municipality assuming "place risks" while targeted developers assume market share risks. In general, it appears that

potential foreign developers have competence in particular business domains but are not as familiar with the nuances of the South African commercial real estate market. Therefore, they may be inordinately reactive to short-term setbacks and pull out. Both ACSA and Ekurhuleni will face their own risks should investors bolt. It may thus be worthwhile to structure agreements with potential developers in a way that more efficiently shares risk.

Given that aerotropolis development is a long-term project and that needs and conditions will likely change over the coming decades, aerotropolis developers need to have contingency plans to support strategic actions in a time of potential crisis. Improved market information will reduce risk and structured agreements with developers and operators will help manage risk.

In any case, long-term plans may need to be adjusted in reaction to variations in market timing and the attractions of commercial agglomerations (at ORTIA or Ekurhuleni). Considering the types of contingencies, their possible impacts on the ORTIA Airport City and Ekurhuleni Aerotropolis, and potential strategic interventions ahead of time may speed reactions in time of need and improve the quality of decisions. All this is key to risk management.

To conclude, ACSA and Ekurhuleni have a good vision for their Airport City and Aerotropolis plans that is consistent with airport-linked commercial development. Their vision and plans needs to be backed up by solid facility demand forecasting and both risk and contingency analysis. These should be

conducted with 5, 10, 15, 20, and 30 year development milestones. Numerous business and commercial development cycles will likely have passed during this period generating ups and downs. Thus, both ACSA and Ekurhuleni should keep their eyes on the long term in strategic planning and do their best to insure that all commercial facilities in the ORTIA Airport City and Ekurhuleni Aerotropolis are economically viable, physically attractive, and contribute to sustainable development. With these three guiding principles, long-term prospects for success will be greatly improved.

3.12 Marketing Principles Tied to Functional Capabilities

I turn now to guidelines for a marketing strategy to help ACSA and the EMM attract investors and more logistics service providers to ORTIA and the broader Ekurhuleni Aerotropolis. I will assume that for the immediate future ACSA management will play the leading role and responsibility for promoting the ORTIA Air Logistics Hub and Airport City and the EMM having responsibility for the Ekurhuleni Aerotropolis. This includes identifying and attracting viable service providers, business and industries to all these.

In the next chapter, I will make recommendations regarding ways to enhance the commercial success of ORTIA and the Ekurhuleni Aerotropolis in a complementary, reinforcing manner. Suffice it to note that eventually both

ACSA and Ekurhuleni may wish to retain a master developer to help market, finance, develop, and manage its Airport City and commercialized new logistics sectors of the airport, while Ekurhuleni may consider joint venturing or teaming with international commercial real estate developers for overall Aerotropolis development.

Among the master developers' primary responsibilities would be helping secure up-front investment capital and the promotion of major commercial zones including the creation of a marketing program for the ORTIA Airport City and Ekurhuleni Aerotropolis, as well as the air cargo/logistics complex, complete with public relations, advertising and provision of website material, to the identification, contact and recruitment of potential commercial and industrial tenants and users, as well as logistics service providers. Highly regarded master developer partners might also be able to help secure needed long-term commercial real estate financing. The reason I endorse having the master developer (or possibly multiple master developers) is simple. They bring extensive core competencies, experience, and networks to commercial real estate development to the table.

Because fast-cycle logistics leverage by ORTIA is so central to Ekurhuleni Aerotropolis development, I concentrate below on developing and marketing its future logistics and cargo facilities. I will also briefly address ORTIA Airport

City and Ekurhuleni Aerotropolis phased development and corresponding marketing goals, returning to these in the next chapter.

3.12.1 Phased Development and Associated Marketing Approaches

Recall that the ultimate objective of the OALH (ORTIA Air Logistics Hub) is to serve as a major air logistics complex offering tenants and users state-of-the-art infrastructure and commercial support. Based on experiences air logistics airports elsewhere, to achieve of this goal, the ORTIA Air Logistic Hub will likely evolve through a series of phases. In each phase, the marketing effort should be designed to attract a nucleus of appropriate facility investors and users, which in turn serves as a catalyst to attract additional complementary companies to the complex and to the greater Ekurhuleni Aerotropolis.

The kinds of investors and tenants likely to be attracted to the OALH will vary with each phase of the complex's infrastructure and facility development. Marketing activities should be planned to match these anticipated development stages and tailored to the kinds of tenants that are most suitable to each stage, and not outrun physical development stages. If marketing gets ahead of these improvements, credibility will be lost and the targeted tenant or potential investor will become disenchanted. The marketing time table is set to roughly

correspond to the development of the evolution of the midfield cargo terminal, the Logistics Special Economic Zone, but obviously precede it to some extent.

a. Near Term

The near term represents a period over the next 5 years (2012–2017). Based on surveys of potential users of air logistics hubs elsewhere, the near-term marketing strategy should not only focus on facility development but also on attracting additional air cargo service to grow existing service. Though I understand that efforts by ACSA's cargo division have already been made to attract additional air cargo service, these efforts should be stepped up even further. Integrated air express carriers are also seeking new regional bases and close contact needs to be maintained with these firms. ORTIA has an excellent strategic location for serving many of the key cities on the African continent so strong continuing efforts could pay off in landing such a regional hub.

For future major commercial precincts at ORTIA and the broader Ekurhuleni Aerotropolis, master developers need to do appropriate land valuation and facility demand forecasts prior to marketing. This should flesh out fuller conceptual master plans following these forecasts and guidelines in this report. For the broader aerotropolis area, basic zoning and land-use planning should also be completed with revised conceptual

master plans developed for each aerotropolis zone that complement (rather than compete with) commercial development plans for ORTIA Airport City precincts. The revised conceptual master plans could be valuable marketing tools in gaining the interest of potential future investors and developers. Close coordination is required in planning both ORTIA Airport City and Ekurhuleni Aerotropolis development with government bodies providing transportation infrastructure and potential developers together with the financial community for capital investments.

b. Mid-Term

The mid-term for ORTIA development marketing represents roughly the years 6 through 20 (2018–2032), including some earlier year overlay with near-term activity. This period's marketing strategies should be designed to continue to boost passenger and air cargo demand at ORTIA and then to further expand this demand by progressively widening and deepening the nature of goods processing and commercial service activities located at and around the airport. Key components of these strategies include:

- Attracting additional air cargo and passenger service.
- Targeting industrial and commercial users of those air services.
- Encouraging improved logistics management.
- Preparing for the full integration of production and logistics.

- Siting key firms in designated airport and aerotropolis zones.

While the above strategies are broadly sequential, there would naturally be substantial overlap among them. Most important, the impact of this marketing will be cumulative, with efforts in prior stages leveraging expanded development efforts in the following ways.

(1) Attracting additional air cargo service providers

The engine that drives the aerotropolis (ORTIA) is fueled by its air connectivity (number of markets served times frequency of service to these markets). Expanded air service not only builds connectivity but also makes the airport and its surrounding areas more attractive destinations for aviation-linked businesses of all types (international business services, tourist facilities, time-critical goods processing firms, etc).

Since the vast majority of ORTIA's cargo is carried in the bellies of its passenger aircraft, developing more extensive route structures by such aircraft will bolster cargo and cargo-related business. With an ultimate capacity of 66 million PAX, predicated on the runway system finally adopted (which may be further increased through NextGen air traffic control technologies), there will be ample opportunity to expand air service.

Yet the biggest challenge to expanded air service may not be airport and airport approach surface infrastructure, but ORTIA's growing competitors elsewhere in Africa. While ORTIA remains the continents largest passenger hub, other African hubs such as Nairobi, Accra, and Lagos are beginning to emerge as competitive challengers in capturing new international air service due to their domestic market size (Nigeria), economic growth rate (Ghana), locality advantage and ambitious flag carrier route expansion (Kenya).

There is also the need for ORTIA to expand its all cargo aircraft service, including charter air cargo operator. Previous surveys have indicated that charter air cargo operators (e.g., Atlas Air, BAX Global, Cargolux, Evergreen, and Polar) serve airports where they can be assured of a significant volume of airfreight. The key to building a critical mass of cargo demand will be to focus on promoting ORTIA as the preferred air logistics facility for shippers in Africa that are airfreight dependent. The intent here will be to persuade the firms not necessarily to relocate to the Ekurhuleni Aerotropolis area (though this would be ideal), but to use ORTIA rather than any other African continent airports for air cargo shipments. This marketing should correspond to improving air cargo infrastructure and facilities at ORTIA.

To build cargo volumes will require closer working relationships with major freight forwarders and third-party logistics service providers. Initial marketing targets should focus on international 3PL's, freight forwarders and shippers of time-sensitive products. The latter include aerospace and microelectronics companies, pharmaceutical firms, fresh cut flowers, fresh produce and seafood, and other high value to weight export products. Marketing strategies geared to shippers, freight forwarders, 3PL's and air cargo firms should emphasize the value-added that ORTIA and the Ekurhuleni Aerotropolis can contribute in terms of lower cost and faster, more efficient operations. During this mid-term phase of marketing, ORTIA should become a much more significant air cargo airport, featuring greater cargo volumes with highly efficient materials handling and transshipment capabilities through its new cargo terminals and associated logistics IDZ.

(2) Attracting Additional Air-Intensive Commercial Users to ORTIA and the Ekurhuleni Aerotropolis

As ORTIA's air cargo service further expands, reciprocal ACSA-Ekurhuleni marketing should focus on attracting shippers (i.e., manufacturers and assemblers of export products) and more international freight forwarders and third party logistics providers (3PLs) to locate at

and around ORTIA. The goal will be to begin generating on-site origin/destination cargo shipments in terms of in-bound raw materials and components and out-bound intermediate and final goods flowing to and from the time-sensitive manufacturers and distributors that operate in the Ekurhuleni Aerotropolis and Gauteng. Again, the emphasis should be on demonstrating a set of real cost, speed, and service quality advantages to firms locating near or using ORTIA (including its new midfield cargo terminal and proposed Value-Adding Logistics Special Economic Zone) that are compelling to shippers, forwarders, and 3PLs. Not the least of which, to repeat, will be increasing ORTIA's connectivity via passenger and cargo aircraft which is measured both by the number of international markets served and the frequency of service to these markets.

c. Longer-Term

The longer term (years 20 to 35 with some earlier year overlap) will focus on developing a full-scale logistical complex in the Ekurhuleni Aerotropolis and possibly attracting the necessary additional complement of aviation-related perishables shippers, manufacturers and logistics providers to accomplish ultimate fast-cycle logistics objectives. There are some prerequisites that will have to happen earlier, however.

(1) Improved logistics management (years 10 to 15)

Within 10 to 15 years the new northern cargo area (including the Logistics SEZ)will have begun to develop a complement of logistics support services. Pointing to the importance of these features for cost-effective logistics, plus the record of efficiency that ORTIA should have established for its tenants and users to that date, marketing programs will begin to focus more on the advantages of ORTIA and its surrounding Aerotropolis in overall logistics management. The marketing emphasis should be on helping industrial and commercial shippers and 3PLs find opportunities at and around ORTIA to coordinate the movement of materials and finished goods so that they can rapidly and flexibly respond to customer's needs as well as to cut costs and increase supply-chain management efficiency.

The possibilities of performing value-added logistics functions in the SEZ such supply-chain sequencing, pick and pack, product labeling, and assembly of knock-down product kits should be stressed. Marketing targets during this phase should be the companies throughout the African continent, plus the whole spectrum of major freight forwarders and third-party logistics providers that serve shippers globally. The logistics IDZ along with ORTIA's new midfield cargo facilities' later capabilities in automated warehousing/distribution, electronic data interchange, and

electronic tracing-tracking will be underlined for these logistics specialists. The value proposition for marketing during this phase should not only emphasize cost and quality of service advantages, but also the enhancements to the speed and agility of supply chain operations that ORTIA and the Ekurhuleni Aerotropolis will provide shippers and 3PLs.

(2) Integration of production and logistics (years 10 to 20 and beyond)

As ORTIA develops its international reputation for world-class cargo handling and logistics management, another stage of marketing can begin. The emphasis at this point would be essentially an intensification of the "improved logistics management" marketing theme set forth above, whereby the marketing program will concentrate on supporting shippers, forwarders, and 3PLs to find ways to integrate production and logistics so as to substantially reduce inventories and further improve manufacturers' supply chain management. This is where the logistics and site upgrades in described in Chapter 2 will play a significant positive role.

Web-based promotional materials must seek to differentiate ORTIA and the Ekurhuleni Aerotropolis from other industrial-logistics complexes as sharply as possible in terms of the price, quality, speed and agility benefits that it offers. The Ekurhuleni Aerotropolis will at this point be marketed internationally to the most sophisticated shippers and

3PLs as a site where high-tech and other airfreight dependent manufacturers can fully coordinate and integrate their supply chains and overall manufacturing capacity with customer demands. The marketing message should also stress ORTIA's and Ekurhuleni's world-class standards in total logistics management practices including multiple transportation modes (with connections to Aerotropolis inland ports and logistics villages[see Chapter 2]), and advanced telecommunications, sophisticated materials handling systems, and state-of-the-art commercial and knowledge support services, also described previously.

3.13 ORTIA Air Logistics Hub/Ekurhuleni Aerotropolis Target Industries

At every stage of OALH and aerotropolis marketing, the promotional strategy should be grounded in solid business research and planning. This will involve market research of a generic nature on likely firm tenants and users, given its stage of development, as well as market research specific to the Ekurhuleni Aerotropolis and Gauteng Province.

In terms of boosting cargo, research on commercial shippers from around the world points to five generic types of shipments where air transport is the consignees' mode of first choice. These are when:

- Flexible and customized production is the norm.
- The high value of the product compared to its weight justifies the extra cost of airfreight.
- The product is perishable—either in the organic or economic sense.
- Short production cycles and/or "just-in-time" inventories require air freight.
- Immediate delivery of spare parts, time sensitive documents or products is required.

Target industry analysis for air logistics hubs conducted by the University of North Carolina's Kenan Institute of Private Enterprise identified eleven industrial groups that are most likely to utilize the facility. Most of these would no doubt also be the best target industries for ORTIA and the Ekurhuleni Aerotropolis, as well. They include:

- Logistics service providers (forwarders, 3PLs).
- Semi-conductor and computer chip manufacturers.
- Pharmaceuticals and contract biotech and pharmaceutical lab testing facilities.
- Computer and electronic sub-assembly manufacturers.
- Aircraft assembly, aircraft parts suppliers and aircraft maintenance services.
- Garments and fashion accessory suppliers.
- Specific elements in the scientific or medical industrial supplies business, particularly those supplying small volumes of high value products, for example aromatics.

- Optics and small precision equipment manufacturers.
- Suppliers of perishable products—for example, fresh seafood, live animals, fresh fruit and flowers.
- Digital automotive component manufacturers and spare part suppliers.
- Gems, jewelry and watch manufacturers.

For service sector and business service oriented firms whose demands were discussed earlier in this chapter, facility forecasts need to be conducted. Highest and best use land parcels for these service sector facilities in the Ekurhuleni Aerotropolis must also be determined taking into account current and likely future infrastructure accessibility.

In targeting these firms and others in the sectors, noted above, there are a number of supporting services that need to be highlighted in a marketing plan for the ORTIA Air Logistic Hub and the Ekurhuleni Aerotropolis. Many have already been discussed and some already exist, but let me provide a summary list of the key support services to be implemented and leveraged in marketing ORTIA and its surrounding aerotropolis.

- Expedited customs clearance and pre-clearance procedures.
- Full electronic data interchange capability.
- Special Economic Zones and in-transit bonded status for re-exports.
- New and improved highway access to ORTIA (especially its cargo terminals and logistics SEZ) as well as its surrounding aerotropolis.

- Intermodal inland ports and associated cargo villages.
- State-of-the-art materials handling services.
- Reliable utility services (e.g., electricity, natural gas, water, sewer).
- Industrial support services such as repair and maintenance and machine shops.
- Quality of life—good housing, schools, restaurants, recreation and nightlife.
- Knowledge and education support, including a distance education and worker training facility in the Ekurhuleni Aerotropolis.
- Enhanced one-stop servicing for foreign investors.
- Expedited site and building permit approvals.

All of the above need to be woven into both the business plan and the implementation plan for a fully integrated ORTIA Air Logistics Hub and Ekurhuleni Aerotropolis. These are not only essential to boosting air cargo at ORTIA, but also to developing a successful Ekurhuleni Aerotropolis.

3.14 Conclusion

This chapter presented the main elements that should guide development of a full business plan for a ORTIA Air Logistics Hub, Airport City as well as for its surrounding Ekurhuleni Aerotropolis, highlighting pertinent findings from related studies. Focus was on creating a competitive business environment at

ORTIA and surrounding aerotropolis, including business resource needs, functional capabilities required, new IT initiatives, fostering ORTIA's cargo development and expanding air service, commercial facility demands, as well as forecasting these demands, marketing strategies and target industries. Special emphasis was given to generating logistics-based capabilities at and around ORTIA (the aerotropolis engine) and an integrated logistics system that provides advantages of speed and agility to goods-processing firms throughout the Ekurhuleni Aerotropolis and Gauteng Province. In the final Chapter, I will present additional air logistics hub, airport city, and aerotropolis planning guidelines and provide a set of recommendations and action steps to move all three forward.

Exhibit 3.1. Proposed Hard and Soft Infrastructure for the Ekurhuleni Aerotropolis

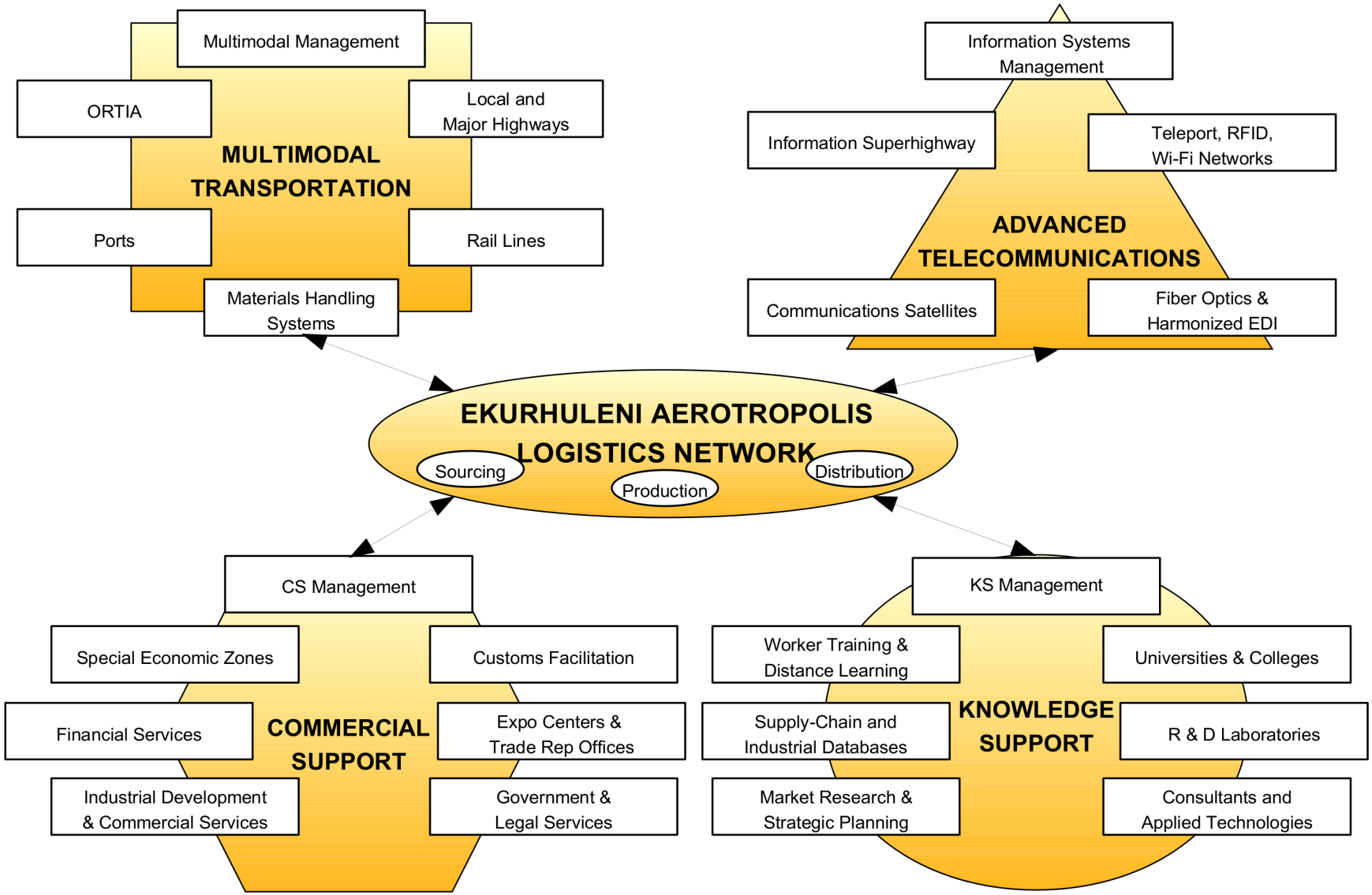
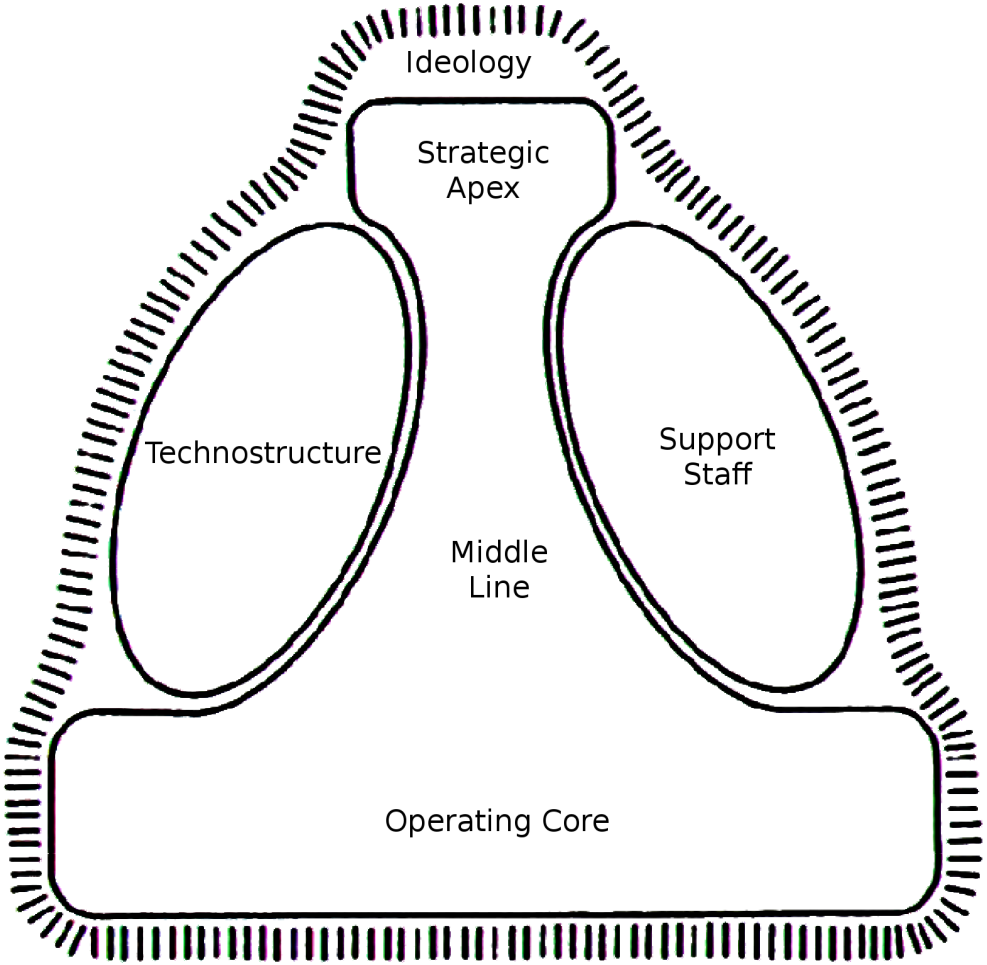


Exhibit 3.2. Six Basic Components of an Organization



Chapter 4

ORTIA Air Logistics Hub/Airport City and Aerotropolis Implementation Plan Guidelines

4.1 Introduction

In the previous two chapters, infrastructure and facility plan guidelines and business plan guidelines were provided for a ORTIA Air Logistics Hub (OALH), Airport City, and greater Ekurhuleni Aerotropolis. Building on these two chapters, this chapter will present guidelines for an implementation plan, including (1) initial phasing of OALH, Airport City and Aerotropolis development; (2) design standards to promote ORTIA and Ekurhuleni Aerotropolis aesthetics, place identity, and sustainability; (3) elaboration of infrastructure and marketing phasing; (4) incentives to attract and leverage appropriate industry; (5) communication, coordination and cooperation among key stakeholders with airport and aerotropolis oversight; and (6) alternative mechanisms for managing OALH and Ekurhuleni development and operation. The last will focus on partnership approaches to financing and managing the value-adding logistics special economic zone and for brining in private-sector master developers for Airport City and Ekurhuleni Aerotropolis commercial development. The chapter concludes with 37 recommendations for ACSA,

Ekurhuleni, and other stakeholders/planners to improve prospects for successful development of the proposed ORTIA Air Logistics Hub, Airport City, and greater Ekurhuleni Aerotropolis.

4.1.1 Infrastructure Phasing and Commercial Development Timetable

The ORTIA Air Logistics Hub and Airport City are conceived ultimately as (1) a fully integrated multimodal logistics, telecommunications, manufacturing, and logistics support system and (2) a major airport-based commercial complex. In reality, they will likely evolve over a 5- to 30-year-period through a series of overlapping development stages. Understanding this is necessary for marketing and to making prudent investments in infrastructure and facilities based on and timed to passenger, cargo, logistics, industry, and business/commercial demands.

The short-term, mid-term, and long-term infrastructure and facility phasing for the ORTIA Air Logistics Hub (OALH), Airport City, and Ekurhuleni Aerotropolis were noted in Chapter 2 and discussed further in Chapter 3. The marketing phasing appropriate to each of these development stages was presented in Chapter 3 along with guidelines for forecasting facility demand and corresponding risk/contingency analyses. Below I present initial development

actions and guidelines for institutional, infrastructure and facilities implementation, beginning with ORTIA development needs and then guidelines for Ekurhuleni Aerotropolis development.

4.2 Initial Development Steps

All major real estate components of ORTIA and the Ekurhuleni Aerotropolis should have updated land valuations and market opportunity assessments, facility demand forecasts, parcel development priorities, and, where necessary, regulatory approvals. As appropriate, future internal roadways and utility corridors should be laid out and general commercial land use and facility plans proposed for the next 30 years. This includes an Ekurhuleni Aerotropolis master plan confirming, correcting, and elaborating infrastructure and facility conceptual plans and guidelines discussed in Chapters 2 and 3 of this report following Aerotropolis principles.

Integrated planning partnerships among federal, provincial and Ekurhuleni agencies and jurisdictions as well as ACSA should be solidified early on to foster communication coordination and cooperative actions necessary to achieve OALH, Airport City and Aerotropolis development objectives. This may involve setting up an aerotropolis public-private partnership organization or other type of institutional arrangement as will be elaborated later in this chapter.

During 2012–2013, South African government approval should be obtained for the logistics special economic zone, and site preparation commenced, including utilities and internal road access for truck cross-docking to proposed logistics facilities, new facility site grading and any possible soils issues. Likewise, airport area roadway improvements, including new interchanges by-pass road construction to remove choke points previously noted should be completed during this period as should appropriate road access to ORTIA's cargo/IDZ precinct. Plans for improving future multimodal access to ORTIA from key aerotropolis nodes should be established with corresponding timetables for improved multimodal linkages and other integrated surface transport.

An Ekurhuleni Aerotropolis master plan should be completed by 2014 based on the principles and guidelines of this report, including first-stage commercial facility demand forecasts. The Aerotropolis master plan itself should include ORTIA's Airport City and its facility demand forecasts to avoid commercial redundancy or over-saturation and to foster development synergies. It would be a huge mistake not to have an integrated airport city–aerotropolis master plan since they are inextricably interwoven parts of a single airport-centered economy and geography. To the extent possible, the Ekurhuleni Aerotropolis master plan should offer economically reinforcing protocols for

ORTIA Airport City and Ekurhuleni commercial, logistics, and industrial development. This again calls for coordinated ORTIA–Ekurhuleni planning.

I recommend that this aerotropolis master plan follow a three-stage approach. These stages would (1) conduct a more comprehensive SWOT analysis than has been done to date to strategically assess what to do, (2) offer an explicit integrated aerotropolis plan that combines airport planning, urban planning, and business site planning guidelines contained in this report specifying how it should be done, and (3) detail who will be primarily responsible for decision-making, financing, and development of aerotropolis infrastructure and commercial facilities (see Exhibit 4.1).

In all three stages, integrated aerotropolis planning must take place vertically (federal including ACSA, provincial, and municipal), and functionally across the key attributes of urban planning, airport planning, and business site planning (see Exhibit 4.2). These range from integrating ground transportation planning, to land-use planning and environmental impact assessments, to commercial cluster analyses, to investment planning and risk analysis.

Regarding the above, let me reiterate that all new Aerotropolis development zones and their proposed facility uses must be based on solid market analysis, including forecasted demand for particular types of commercial facilities, estimated land improvement and facility development costs, likely revenue generation, and overall financial feasibility in both the near- and longer-

term. This would include a competitor analysis of similar facilities elsewhere in Gauteng Province.

The process would include further analysis and more detailed specification of commercial facilities in the functional zones currently proposed for Ekurhuleni Aerotropolis areas along with continuing to pursue potential investors and tenants. These should include, among others, land parcelization, functional use designation, design standards that craft an aviation "theme" or brand identity for the aerotropolis, infrastructure and utilities requirements, and initial renderings of buildings and physical layout, including landscaping.

The aerotropolis master plan should also contain a marketing approach to brand and promote the Ekurhuleni Aerotropolis and its functional zones and to commence recruiting investors, developers, tenants and users. Based on the master plan, a multimedia marketing campaign to promote the Ekurhuleni Aerotropolis (including ORTIA Airport City) should be put in place by marketing/development partners.

Related to marketing, theming (placemaking),and aesthetics, aerotropolis planners should also provide basic design guidelines and form-based codes which I will elaborate upon in a moment. An Ekurhuleni Aerotropolis economic impact analysis should also be conducted updating and expanding the Demacon study for Rhodesfield demonstrating potential gains in investment, jobs,

business sales and taxes, which will be beneficial in gaining broader political and public support.

To guide growth in a unified and expedient manner, Ekurhuleni and Gauteng Province should consider adopting coordinated land use and transportation plans. Perhaps one of the more effective strategies for ensuring compatibility, if not absolute consistency, in local regulations would be to create an informal Ekurhuleni Aerotropolis regional partnership. As a consensus emerges on the broad outlines of the vision, specific zoning and regulations could be enacted to support that collective vision. Not only will such coordinated plans help ensure more consistent development in consonance with the general plans outlined in the aerotropolis vision and future master plan, but also better planning could expedite the development approval process, reducing considerable cost of contemporary real estate development.

In addition to land use codes and zoning that coordinate with present and planned transportation infrastructure described in Chapter 2, the Ekurhuleni Aerotropolis master plan should at least consider form-based codes which establish general design standards for airport area buildings, walkways, travel lanes, landscaping, and public spaces. While a consistent Aerotropolis "look and feel" is desirable, there is no reason development form must be entirely consistent throughout the Ekurhuleni Aerotropolis—or necessarily throughout a particular zone or precinct. Form-based codes help localities implement their

specific visions. They are a mechanism for informing potential developers of the expectations, avoiding one of the major stumbling blocks to real estate development, and enhancing overall benefit. Such codes complement widespread zoning attention to permitted uses for particular sites and the separation of incompatible uses—which is especially important in airport-linked development that could eventually impede necessary future airport growth.

Form-based codes are important to achieving the aesthetic standards that are increasingly required to make large-scale real estate developments competitive. They also help insure that building standards and other design elements that will promote future real estate value in the area are maintained.

Flexibility is critical, however, not only with design standards but also with the very nature of commercial development. Schiphol's Aerotropolis strategy emerged only after significant private investments, deviating from earlier plans, were already in place. Adapting to market conditions and special opportunities that arise for industrial/commercial development in Ekurhuleni and in areas miles beyond requires such flexibility. In short, Aerotropolis plans should never be set in stone but serve as helpful guidance.

4.3 Providing Appropriate Investor Incentives

Virtually all countries are in the incentives game, now, so its relative advantage in attracting major investors and industry is declining. New incentives to attract and grow industry must be pursued. The ORTIA Air Logistics Hub (OALH), itself, can be one of the most powerful incentives. This is because operational incentives will be at least equally important, and in the longer term likely even more significant, than tax incentives in attracting time-critical, high-value goods-processing and distribution industries.

What the OALH can accomplish following guidelines in Chapter 2 is to provide Ekurhuleni Aerotropolis industries with speed and agility in their supply chain management, far superior to other locations in Africa. As the OALH evolves through its stages, it will drive greater more advanced industrial development throughout the Ekurhuleni Aerotropolis. This additional development, in turn, will generate increased volumes of cargo and passengers at ORTIA via reinforcing airport-aerotropolis synergies.

The South Africa government is pursuing a powerful investor incentive that could substantially leverage the ORTIA cargo/IDZ precinct and the Ekurhuleni Aerotropolis. This is federal law establishes Special Economic Zones to attract domestic and foreign investors into targeted priority sectors.

These zones provide infrastructure and facilities on terms such as (1) Customs posts operating 24/7 with less paperwork, (2) tax exemptions and lower corporate tax rates for investors in the SEZs, (3) other tax benefits which incentivize the location of companies which import expensive components into South Africa from abroad and export assembled goods, (4) one-stop-shop ("single-window") investment support and documentation assistance covering all South Africa agency requirements, and (5) support for worker training.

4.4 Coordination and Harmonization with Similar Facilities Elsewhere and with Key Actors, Government Units, and Organizations

If parts, components, and finished goods are to flow rapidly and seamlessly between ORTIA (and other transportation facilities within the Ekurhuleni Aerotropolis) and facilities throughout Gauteng, it is essential that their information technologies and materials handling systems be harmonized. This requires using standardized EDI messages with compatible, open architecture software systems, as described in Chapter 2.

Containerization, as noted, must also be standardized across shipping modes so, for example, that containers arriving at one of South Africa's ports or the Ekurhuleni Aerotropolis intermodal rail facility can be transferred efficiently by truck to the airport or other key nodes in the aerotropolis. Since containers

may also be air freighted via wide-body aircraft from ORTIA, they must be made compatible with materials handling equipment for loading on all-cargo aircraft. Multimodal materials handling harmonization will require close coordination between ORTIA the greater Ekurhuleni Aerotropolis and all other modal points.

When purchasing material-handling equipment, and building key infrastructure such as ORTIA's midfield cargo/IDZ precinct or future Ekurhuleni intermodal rail facilities, careful consultations should be made with major air cargo, sea cargo, and surface cargo handlers throughout world. It would be a terribly expensive mistake not to coordinate design of facilities at and around ORTIA with the predominant technologies, materials handling equipment and space utilization standards at major ports and airports which will serve as South Africa's trading partners.

In terms of recruiting additional air cargo service providers to ORTIA, it is recommended that the ACSA work with major freight-forwarders and 3PLs, and visit other major air cargo hubs to examine systems in operation there. Through the latter, an excellent vision can be obtained of the direction that air cargo handling is taking with a variety of automated and semi-automated cargo operations as well as other processes and procedures being implemented at these airports to speed the flow of goods through the airport.

Let me add that air express companies such as FedEx usually have their own facility design firms. Contact should be made with these companies and

advice received before any air express facility development contracts are consummated for ORTIA's midfield cargo precinct. As a special incentive to a prospective air express or air cargo firm locating at ORTIA, management may wish to offer to build a cargo facility to suit with a long-term lease-back contract. For example, Amsterdam Schiphol Airport attracted Polar Air Cargo by offering to build a permanent cargo facility to house the airfreight carrier's transshipment needs and then lease it back. The North Carolina Global TransPark acquired a major grant from the State's Golden Leaf Foundation to build the Spirit AeroSystems A-350 fuselage and wing facility at the airport and lease it back at a nominal fee.

Finally, it is essential that a process be established that brings all key actors, government units, NGOs, and other stakeholders together with a three-stage outcome: (1) communication, (2) cooperation, and (3) coordination. Without this happening, the whole aerotropolis planning and development process can be set back and potentially jeopardized.

This gets back to the issue of governance and community relations. All stakeholders must feel they are part of development planning from the start. Aerotropolis regions such as Memphis and Detroit in the U.S. have established cross-jurisdictional public-private steering committees to move aerotropolis planning forward. Having appropriate South African federal agencies and local governments involved, and encouraging community, environmentalist, and

other NGO participation early on can avoid major confrontations and project delays down the road while potentially contributing to a more acceptable, appealing, and sustainable Airport City, logistics hub, and aerotropolis development process

4.5 Placemaking and Branding the ORTIA Airport City and Ekurhuleni Aerotropolis

Placemaking (providing identity to a place) and branding are essential elements for successful ORTIA Airport City and Ekurhuleni Aerotropolis development. They are fundamentally processes of marketing communication. In academic terms, these processes signal an underlying reality to the commercial development process. The most effective signals are expensive. That is, visible features that could not exist without real place advantages are the best elements of placemaking and branding. Advertising and promotional campaigns before recognizable development occurs tend not only to be relatively expensive and not integrated with everyday realities, but generally not effective at placemaking and branding. Advertising and promotional campaigns can be effective when the audience can readily see tangible development and when independent parties spread the message.

Demonstrated success is perhaps the most effective branding strategy. For example, air cargo processors sometimes count the number of trucks in a region as an indicator of their business prospects. Their reasoning is that, if goods are being moved nearby, they have a chance at tapping into that market. As I noted above, the presence of successful aviation-oriented firms in a location is a very effective brand creator. Real estate developers are therefore often willing to make large concessions in order to attract prominent tenants in early stages to their properties. In this section of the report, I consider two additional proven placemaking and branding strategies: urban design and concerted visible collective governance actions.

Urban design, a key component of aerotropolis design, is located at the intersection of planning, architecture, landscape architecture, and transport planning. It is primarily concerned with three-dimensional design but human reactions to noise, smell, and feelings of safety/danger or of feeling welcome are also important. Each of these design considerations is salient in Airport City and Aerotropolis development.

Sometimes seen as a mediator between architecture and planning, urban design focuses on external space and the relationships between different forms of movement and physical space. Architects have expertise in terminal design and, increasingly, airport site development. Industrial engineers know how to plan manufacturing and logistics facilities. Transportation planners help facilitate the

movement of people and goods. Many planners also have experience in analyzing regional land use needs. In between each of those often separate concerns is a design problem that can significantly affect the economic efficiency, environmental sustainability, and aesthetic appeal of urban areas, the three key objectives of Airport City and Aerotropolis planning and development.

Surprisingly, many of the basic principles of Airport City design have been known and discussed since at least 1950. Their history even reaches back to the 1920s when Le Corbusier, inspired by Berlin's Tempelhof Airport which was in operation until October 2008, tried to integrate air travel into urban design. The advent of commercial jets created a disruption but even this does not explain the poor planning and urban design surrounding so many airports around the world.

Architecture provides an important component of aerotropolis aesthetics. Another consideration is "wayfinding." As airport cities and aerotropolis regions increase in size and the number of local destinations increases, particularly visiting air travelers need help in finding their way. Moreover, airport access corridors, like passenger terminals, are important urban and regional gateways. Airport access corridors should provide interpretable paths that welcome residents and visitors and lead them to their destinations. They should also reinforce the image and assets of the Airport City and Aerotropolis, rather than detract from them.

Form-based codes, as I stated previously, should establish general design standards for airport area buildings, walkways, travel lanes, landscaping, and public space. Placemaking and wayfinding enhanced by thematic architectural features, public art, and iconic structures should make aerotropolis developments interpretable, navigable, and welcoming.

These principles and guidelines need to be applied to the ORTIA Airport City and to the Ekurhuleni Aerotropolis as a whole. The problem is more complex, however. The aerotropolis needs to be interpretable to goods transportation personnel: the truck drivers ferrying shipments between logistics facilities and airports. Tourists must be guided in a positive fashion, as well. They need to be able to "feel" their paths as they approach. Here is where form-based codes, setting standards for building and landscape appearance, as well as architectural aviation theming and iconic structures can become an integral component of placemaking and branding both the ORTIA Airport City and Ekurhuleni Aerotropolis.

4.6 Institutional and Management Guidelines for the Ekurhuleni Aerotropolis Development and Operation

Considerable thought and work has been done to date on appropriate institutional and management plans for financing, developing and operating a

multimodal air logistics hub, Airport City, and Aerotropolis. One approach used in the U.S. is to create a special public authority to finance, develop, market, and operate the hub complex. This organization is typically semi-autonomous and has authority to control and coordinate all planning, infrastructure development and facility construction to ensure timely completion of the project. The Authority could also negotiate building service contracts needed to manage the day to day facility infrastructure requirements, as are regularly used by the private sector.

While a single organization such as an authority may be better able to coordinate and manage all aspects of the development of the project since it has a singular focus, the stewardship roles of ACSA and the Ekurhuleni government would be compromised. Moreover, there is no assurance that this authority (which may require special South African legislation) would tap the most appropriate expertise.

A second option would be for ACSA to form a joint venture with organizations that have the expertise to develop both inside the airport fence and outside the fence multimodal logistics complexes. For ORTIA Airport City and broader Ekurhuleni Aerotropolis commercial development, a similar joint venture might be formed with major real estate development firms to market and develop all or selected properties in each area. The master developer partner would be responsible for much of the demand analysis of properties,

advertising, and sales on a commission basis. The ACSA (and Ekurhuleni) must be careful here, though, to make payments success fee based since quite often major upfront and monthly fees get paid to master developers who fail to deliver. I would personally recommend a partnership with a proven Aerotropolis developer such as Gale International which successfully developed the US$33 billion New Songdo City aerotropolis next to South Korea's Incheon airport.

A third option would be for the ACSA or Ekurhuleni to control all development in the logistics complex, Airport City and Aerotropolis and bring expertise in-house through recruitment and hiring. The risk here is that the wrong people would be hired and not be able to deliver results. A dilemma is that while sufficient expertise may not exist among South African labor, foreigners may not be in tune with the culture of the ACSA, Ekurhuleni or broader South Africa business culture, in general, with resulting problems. Furthermore, under this option, like those above, a relationship of some type must be formed with the South African federal government to secure appropriate transportation and utilities infrastructure since the costs of these are well beyond the financial means of the ACSA and Ekurhuleni.

Provincial government relations will also be critical for Ekurhuleni Aerotropolis development and operation. While creating an inter-jurisdictional Aerotropolis Authority may not be feasible, less formal institutional

arrangements can be made. One would be for the ACSA and Ekurhuleni to institute regularly scheduled working sessions with provincial officials and planners to inform them better about the nature of proposed aerotropolis development and explore how their planning might complement and reinforce this new form of airport-linked development for mutual benefit. A larger picture view of the Ekurhuleni Aerotropolis and the province's role in its evolution could reduce competition for entering businesses. Such communication and cooperation could also encourage more coordinated Aerotropolis marketing and branding for business recruitment and lead to more coordinated actions in concert with ACSA to address any airport-induced problems affecting nearby communities.

4.7 Conclusion: A Ekurhuleni Aerotropolis Decision Point

I have reiterated throughout this report that an aerotropolis is more than a busy airport and it is more than expensive surrounding infrastructure. It is a tightly-linked constellation of activities involving airlines, the airport, and many organizations which provide services and generate income for the provincial economy. I have also articulated why ORTIA, as the multimodal commercial engine of an emerging Ekurhuleni Aerotropolis, may well be the most important asset proposed by the Gauteng Province and South Africa to compete in the

globally-networked, speed-driven economy of the 21st century. Business and government leaders thus have a responsibility to not only educate the public to this reality but also to grow the ORTIA engine more effectively and leverage its expanded infrastructure to maximize overall benefit to Ekurhuleni, the Gauteng Province and all of South Africa.

In these times of economic stress, there is a tendency for many organizations and local government units to hunker down and protect their immediate interests, rather than taking on bold initiatives that can be transformative for their region and long-term prosperity of its residents. This requires not only strategic vision but decisive, coordinated actions.

To start, developing ORTIA to serve as a multimodal air logistics hub can generate remarkable multiplier and catalytic effects in diversifying and revitalizing the city's and province's manufacturing economy, with the Ekurhuleni Aerotropolis becoming a magnet for high-value goods-processing firms that increasingly depend on speedy connectivity to their suppliers and customers around and throughout South Africa and the world. Corresponding increased ORTIA national and international air service will keep these firms and their executives and professionals better connected while attracting corporate headquarters and white-collar producer services to the Ekurhuleni Aerotropolis and Gauteng Province. The Aerotropolis, itself, can provide the planned physical, business, and institutional environment that will facilitate the

commercial success of all such firms. It is with this vision and objective in mind that I conclude with the following specific recommendations.

4.8 Specific Recommendations and Action Steps

1. It will be increasingly difficult in the future for Ekurhuleni and the broader Gauteng Province to attract new business and industry and generate quality jobs on cost factors and traditional government incentives. Competitive advantage will come through strategic focus on connectivity, speed, and agility. These should become the Ekurhuleni Aerotropolis and the province's primary competitive tools based on fully leveraging an expanded and improved OR Tambo International Airport (ORTIA) as put forth in this report.
2. Competitive advantage based on connectivity, speed and agility requires a new economic engine. The engine proposed is a ORTIA Air Logistics Hub (OALH) that will cornerstone and drive a Ekurhuleni Aerotropolis serving to diversity and upgrade the city's manufacturing sector. This multimodal logistics hub will integrate air, highway, rail and water transportation modes with advanced telecommunications, sophisticated materials handling systems, and state-of-the-art support services to provide OALH and Ekurhuleni Aerotropolis tenant firms

and users with superior capability to respond rapidly and flexibly to future changing market demands in South Africa and worldwide.

3. Improved local roads and airport area highways, and new and extended rail lines are required to integrate ORTIA with aerotropolis business clusters and with other major national and international transport modes. Similarly, state-of-the-art broadband, fiber optics, Wi-Fi, Wi-WAN and satellite uplinks and downlinks are needed for ORTIA's and Ekurhuleni's Aerotropolis companies to trace, track, and control product movements, which in the future will increasingly be monitored and managed through RFID (radio frequency identification), GPS (Global Positioning System), and intelligent software agents (via computer chips embedded in products, parcels, and containers).
4. Just as today's most successful businesses are innovative, flexible, and rapidly responsive, so too must commercial facility planning and design at ORTIA and the Ekurhuleni Aerotropolis. Planning commercial elements of the airport and Aerotropolis thus should not be so much a fixed physical plan as it is a flexible framework for accommodating a wide variety of investors, tenants, users, facilities and commercial activities that can be modified when new demands, new technologies, new industries, and new infrastructure emerge. Both ACSA and Ekurhuleni officials themselves must be agile, prepared to respond

rapidly and creatively to evolving investor, tenant and user needs and to coordinate "one-stop-shop" support from a variety of government and institutional sectors for future ORTIA Airport City and Ekurhuleni Aerotropolis investors.

5. ORTIA's new midfield cargo infrastructure and facilities should also incorporate flexibility and reconfigurability in their design elements. For example, both the cargo terminal and IDZ should employ a modular layout for maximum flexibility and phased development. On-site cargo processing facilities should employ flex-tech principles and be reconfigurable to allow for expansion (or even contraction) as demand warrants. Their connecting surface transportation systems should not interfere with aircraft ground movements and should incorporate redundant routings to minimize impact of congestion or possible accidents.
6. Ekurhuleni Aerotropolis transportation infrastructure should likewise be designed to allow seamless and flexible flows of materials and people among convergent transportation modes and industrial and other commercial facilities both near the airport and outward along transit corridors. Key to this would be planned highways, including a redesigned R21/R24 interchange, a new airport ring road and new rail lines, including appropriate BRT interfaces and proposed future

automated people movers linking key nodes. High-speed rail to Durban and Polokwane should pass by the airport with ORTIA and Ekurhuleni stations. For cargo, rail/truck interfaces should be provided by a new intermodal rail facility at an appropriate Ekurhuleni Aerotropolis site.

7. Greater intra- and intermodal transportation integration is required in the Ekurhuleni Aerotropolis and, as pertinent, Gauteng Province in terms of networks, physical interfaces, schedules, and fares. This will require more extensive coordination of transportation planning agencies in the municipalities and province and with various transportation service providers.
8. Logistics villages should be planned near or at intermodal rail facilities as well as at possibly other strategic surface transportation nodes in the Ekurhuleni Aerotropolis. Features of these logistics (freight) villages were summarized in Exhibit 2.16.
9. A state-of-the-art World Cargo Center should be constructed when demand warrants as part of ORTIA's redesigned northern logistics area. This facility, offering modern electronic Customs clearance technology, would provide off-ramp ORTIA tenants and off-site (Aerotropolis) production facilities, warehouses, and distribution centers with efficient sorting capability, customs clearance, perishables preservation and air freighter access. The new World Cargo Center should be a shared

facility available to all foreign aircraft as well as South African flag carriers who chose to utilize it.

10. The IDZ that has been proposed to initially house a jewelry manufacturing complex should be planned and developed as a value-adding logistics Special Enterprise Zone (SEZ). Consideration should be given to engineering, geological and topographical work needed to develop this logistics SEZ and provide first-order estimates of the costs of constructing internal roads, utilities and preparing each for either logistics/commercial/industrial uses. Negotiations should also commence with appropriate South African government agencies to secure SEZ status at ORTIA when this new legislation is enacted.
11. Apropos the above, preliminary site designs for the entire new northern midfield logistics complex should be prepared so ACSA can obtain a first-order cost assessment for buildings, including efficient truck cross-docks, and other facilities appropriate for a value-adding logistics SEZ. Achieving the SEZ's full potential will rest on creating a value-adding fast and flexible air-road logistics infrastructure and supporting business environment that will substantially accelerate and improve sourcing, production, and distribution activities of all its tenants and users. This should include an enhanced automated customs environment operating 24/7 with open architecture electronic data

interchange (EDI) capability and perhaps (given space availability) developing an on-site logistics education and training facility.

12. Quality design and building standards should be established and maintained in all of ORTIA's logistics and cargo areas. To the degree feasible, the ORTIA' Air Logistics Hub and its surrounding aerotropolis industrial and logistics clusters should be designed to look more like university campuses or business parks than old-fashioned industrial or warehouse areas.
13. ORTIA must support not only logistics activities but also leisure and business air travelers. To the extent possible, logistics, manufacturing, trucking, and cargo handling should be physically separated from flows of business and leisure travelers. For many of these travelers, ORTIA's passenger terminals (and its adjacent Airport Cities) as well as the Ekurhuleni Aerotropolis are the front door to the Gauteng Province and the nation. It is therefore imperative that they provide the most positive first impression. ORTIA's Airport Cities and sections of the Ekurhuleni Aerotropolis closest to the airport should be planned and designed not only for functionality but also architecturally to create a positive "wow" factor. This itself can be a powerful marketing tool attracting future investors and substantially upgrading Ekurhuleni's image.

14. Regarding the above, airport area architecture and other symbols send an important message. All ORTIA and the Ekurhuleni Aerotropolis gateway entrances should thus receive special emphasis in design and image appearance. These entries must set the tone for the development within which the ORTIA Airport City and Ekurhuleni Aerotropolis identity will be established and reinforced through distinctive building architecture, signage, landscaping, and aviation theming. New electronic art technologies with LED and laser lighting designs might be used to project the Airport City's and Aerotropolis's image in a futuristic, but non-gaudy manner. Aviation-themed design standards need to be incorporated into ORTIA Airport City and Aerotropolis plans. This "place-making" or branding is a pivotal marketing and real estate development strategy.
15. Similarly, airport highway corridors in the Ekurhuleni Aerotropolis should be planned and developed as more than a fast and efficient transportation link to the airport. These corridors can also serve as a marketing asset and positive first impression builder of the Ekurhuleni Aerotropolis and the greater Gauteng Province. They should have aesthetic landscaping and visually appealing yet informative signage, including tasteful billboards and electronic art highlighting the culture, history, people and economic assets of Ekurhuleni, Gauteng and the

nation. High design standards for all new structures along aerotropolis corridors and screening of unsightly structures should be pursued. Just as ORTIA will serve as both the calling card and goodbye handshake for tens of millions of annual future travelers to South Africa, so too will the primary highway connectors to the airport. Similar attention to connecting rail corridors should be given as appropriate.

16. In collaboration with Bombela, ACSA, and the Ekurhuleni and Gauteng governments, technical and financial feasibility studies should re-commence on bringing the Gautrain under the CTB and beyond to the Denel precinct and further to Benoni and eastern Ekurhuleni. Without realignment of the rail line, future eastward extension of the Gautrain to the new midfield precinct and ORTIA Airport City South and East will necessitate trains to reverse direction at ORTIA's western precinct and loop around the western periphery of the airport.
17. It is also recommended that the Gautrain service between the Rhodesfield and ORTIA stations be made possible (or parallel rail shuttle service be developed) and that the PRASA and Gautrain stations at Rhodesfield be integrated. This will ultimately boost ORTIA's passenger numbers, reinforce future ORTIA Airport City facility demand, and enhance access to nearby Ekurhuleni Aerotropolis

commercial developments, giving these developments a future boost, as well.

18. Strong efforts must also continue to attract additional international air service to ORTIA. Airlines must be viewed not just as companies, but more as basic transportation infrastructure, no different from roadways and rail. Airlines, like public infrastructure, are shared by all (business, tourists, etc) providing "highways in the sky" that rapidly connect a region to the world. These highways in the sky are "public goods" infrastructures that do not have to be maintained by public money as do roadways and rail infrastructure. ACSA should therefore consider maintaining as low landing fees and other airline charges as financially feasible to attract and retain air service.
19. ACSA and SAA should form a strategic partnership to reinforce ORTIA's primacy and connectivity for mutual benefit and South Africa's interest. Partnerships followed by Singapore Airlines and the Changi Airport group between Cathy Pacific and the Airport Authority of Hong Kong, Air France and Aéroports de Paris, Lufthansa and Fraport, and between Malaysian Air Systems and Malaysian Airports Group provide useful models.
20. Major advances are occurring in air traffic control technology such as NextGen were described in Chapter 2. Based on my and others'

assessments of these technological advances, it seems likely that NextGen I and NextGen II, both targeted for global implementation over the next seven to fifteen years, will substantially increase the capacity of existing runways and reduce the need for future new runways at airports such as ORTIA. Should estimates by the U.S. Federal Aviation Administration be correct, ORTIA will probably meet its long-range (post-2035) aircraft movement needs with three and at most four parallel runways and supporting infrastructure. I therefore see no need to pursue a second international airport site in Gauteng at this time. A new major commercial airport would be very costly and potentially disruptive environmentally and economically. Worse, splitting the long-haul market between the airports would undercut the feeder passenger and cargo densities required to support many international flights. Synergies with other airports such as Rand and Lanseria should be pursued since they contribute to the broader provincial aviation assets. Care must be taken, however, to insure that they complement rather than compete with ORTIA's future development.

21. Because of Ekurhuleni land-use constraints near ORTIA, many airport-linked businesses are locating beyond the metropolitan municipality.

New policies and strategies are therefore called for to free up developabale land near the airport for more appropriate users.

22. An Ekurhuleni Master Plan should be conducted which commences with a thorough census and assessment of all land uses around ORTIA and along its nearby corridors to determine compatibility with the new Aerotropolis model. Zoning and incentives should be developed which encourage aviation-oriented businesses and industry to locate in closest proximity to the airport and to dissuade those businesses and industries that neither leverage nor are leveraged by ORTIA from locating nearby.
23. An explicit aerotropolis corridor development plan should be an important component of an Ekurhuleni Aerotropolis master plan. For example, the R24 corridor linking ORTIA to Johannesburg is developing in an ad hoc fashion with clusters of airport-oriented activity interspersed with inappropriate users along it. In cooperation with Gauteng planners, this aerotropolis corridor development plan should extend beyond Ekurhuleni and also include key rail corridors such as the ORTIA-Sandton Gautrain corridor.
24. All potential commercial developments suggested for the ORTIA Airport City and the Ekurhuleni Aerotropolis need to be assessed through on-going facility demand forecasts, competitor analysis, and risk analysis as is described in Chapter 3. In some cases, investment

grade analyses will be required. Without such analyses, the the chances of making investment mistakes are high.

25. Much more attention in the Ekurhuleni Aerotropolis planning process needs to be given to consumer services facilities and to white-collar business services. While focus should commence with Rhodesfield and Kempton Park, future business park clusters along Ekurhuleni's corridors should be assessed with appropriate recommended sites.
26. To attract "white-collar" office functions to Rhodesfield and nearby Kempton Park, local amenities must be provided for the managers and professional staff who will be employed by them. Such lifestyle amenities include upscale shopping, fine restaurants, and nightlife options along with high quality residential complexes close to the office complexes.
27. In terms of attracting higher-value goods-processing activities such as high-tech industry, planning and marketing the Ekurhuleni Aerotropolis should emphasize the importance of its logistics-based capabilities. High-tech businesses (as with others) will certainly continue to seek traditional investment incentives such as tax relief, investment offsets for land or facilities and subsidized workforce training. However, as noted above, as the competitive priorities of connectivity, speed and agile market response grow in importance, the

relative power of traditional government incentives will lessen. Increasingly, firm siting decisions will be made at least as much on the basis of logistical capabilities of the site and access to national and global markets as on traditional government incentives. This could be Ekurhuleni's trump card. Marketing effort should be designed to attract a targeted segment of Ekurhuleni Aerotropolis firms based on actual capabilities offered which, in turn, would serve as a catalyst to draw additional complementary firms to the immediate airport area and extended aerotropolis in a cluster manner.

28. Attracting time-sensitive manufacturing and distribution industries will require a thorough understanding of modern supply chain management principles and the fast-cycle logistics. To offer a truly marketable competitive advantage, Ekurhuleni with the assistance of Gauteng and Federal economic development agencies, should bring together experts in logistics and supply chain management, multimodal infrastructure development, and information technology to help design applications that would properly integrate and leverage all ORTIA and Ekurhuleni Aerotropolis resources for fast-cycle logistics. Few locations in the world are doing this, so Ekurhuleni can have a first-mover advantage in attracting high-tech and other time-critical industries to its aerotropolis if it takes the lead in seizing this opportunity.

29. ACSA has three options for operating the recommended value-adding logistics area at ORTIA: (1) complete managerial control, (2) outsource control to a 3PL, and (3) create a joint venture with an appropriate 3PL clearly specifying the division of labor and responsibilities. In all cases, Special Economic Zone (SEZ) status should be sought for this area currently, and in its recommended expanded form. Since effectively and competitively operating an SEZ now requires sophisticated 3PL services, it is recommended that ACSA explore forming a strategic or joint venture partnership with a world-class 3PL that has demonstrated superior SEZ or Free Trade Zone management and operational skills.
30. Both ACSA and Ekurhuleni officials should establish a close working relationship with major corporate relocation and site selection consultants, making them aware of ORTIA's and its surrounding aerotropolis's assets, regularly updating them on development progress. In most cases, multinational companies looking to expand or relocate rely on site selection specialists to provide them with a short-list of potential locations to choose from, along with the location's strengths and weaknesses. Likewise, major commercial real estate firms such as Colliers International, CB Richard Ellis, and Jones Lang Lasalle and real estate investment trusts (REIT's) such as Prologis often work closely

with corporations in their site selection and eventual commercial or industrial facility development.

31. Ekurhuleni may wish to partner with a proven aerotropolis development real estate firm such as Gale International in New York which developed New Songdo City near Incheon International Airport for its Rhodesfield redevelopments. Gale International has created and implemented the "City in a Box" aerotropolis strategy allowing city developments of the highest standards such as New Songdo to be fully built in under 15 years.
32. There are lessons to be learned by from commercial development approaches around Amsterdam Schiphol Airport. Recognition by the Schiphol Group and local jurisdictions in the Netherlands that Amsterdam Schiphol Airport was at the center of an expanding territorial complex of airport-linked industrial and commercial development led to the establishment of a public-private partnership to oversee the development of available sites near the airport. This organization—the Schiphol Area Development Company (SADC)—directly manages some of these projects while coordinating all of them. It operates like a quasi-development agency for the broader Schiphol airport area steering new investment to its highest and best use in the greater airport area.

33. Whereas creating an inter-jurisdictional development organizations such as SADC or an aerotropolis authority may not be feasible for the Ekurhuleni Aerotropolis, it is recommended that a non-bureaucratic alternative be implemented to improve chances of coordinated efforts. One would be for ACSA, Ekurhuleni, and Gauteng planners to institute periodic working sessions to foster coordinated efforts throughout the province and to also bring Johannesburg and Tshwane planners and officials on board for discussions on the nature of airport-linked development and explore how their specific jurisdiction might complement and leverage this new form of development. A larger picture view of Ekurhuleni Aerotropolis development along with their municipality's role in its evolution could reduce Gauteng jurisdictional competition for entering businesses, encourage more effective and mutually beneficial place marketing and branding for business recruitment, lead to more coordinated actions to address airport access problems, and realize more beneficial commercial real estate development outcomes for all.
34. If speed and agility are going to be a trump cards for the Ekurhuleni Aerotropolis, its officials will have to move quickly and flexibly when a recruitable firm comes along. Often prospective firms cannot afford to wait a year or more (or even six months) to get their site plan and

building permits approved. It is therefore highly recommended that appropriate government agencies establish an accelerated site and building plan approval process for Ekurhuleni Aerotropolis area that can be completed in under 100 days from application.

35. Powerful environmental movements are spreading throughout the world that could threaten commercial aviation and airports on a range of noise, local pollution, and global greenhouse gases issue. ACSA should maintain its initiatives in green airport planning and development as should Ekurhuleni Aerotropolis officials on environmentally sustainable planning and development. This will position ORTIA and the Ekurhuleni Aerotropolis favorably during likely intensifying debates on aviation and airport impacts on the environment.
36. Ekurhuleni government officials have a responsibility to guide land-uses around ORTIA so that they leverage and are leveraged by the airport. Encroachment by residential development and conflicting land-use that could hinder required future airport expansion must be prohibited through strict zoning and enforcement of this zoning. Transition of incompatible land uses that might prevent the airport from its future necessary expansion of passenger and air cargo activities should be a priority.

37. ACSA, the EMM and Gauteng Province may wish to intensify the branding of the Ekurhuleni Aerotropolis. To some extent, the media is the message. Such intensified branding could be instrumental in creating "buzz" in marketing to potential outside investors, developers, tenants, and users of ORTIA, Ekurhuleni, and the entire province. It will also provide an excellent "place-making" framework for municipalities and the province to come together under one branded umbrella for mutually beneficial development.

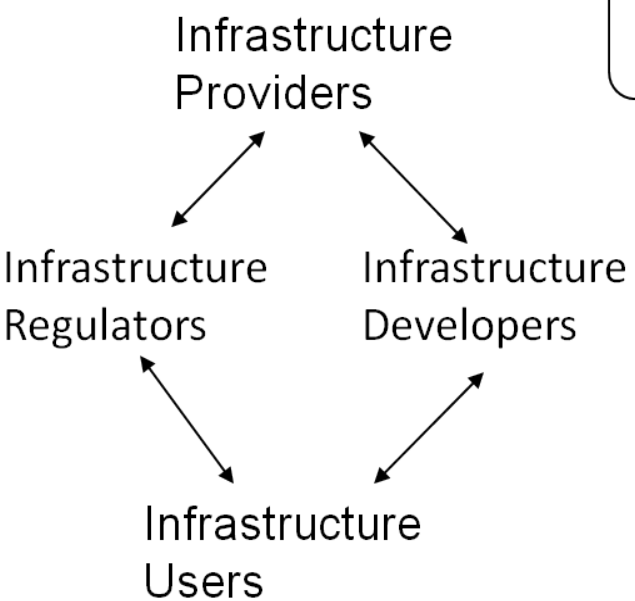
Exhibit 4.1. Three Stages of Aerotropolis Planning and Development

Strategic Assessment

	+	-
Inside	**S**	**W**
Outside	**O**	**T**

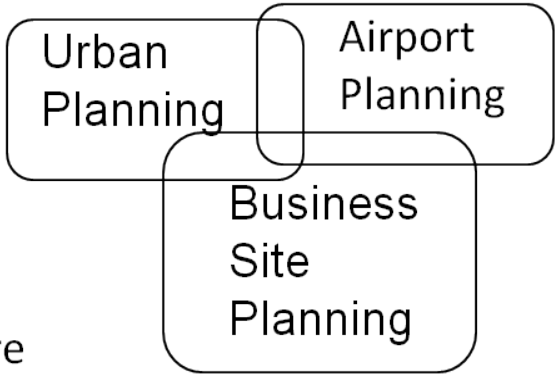
What to do?

Decisions & Guidance



Who will do it?

Implementation

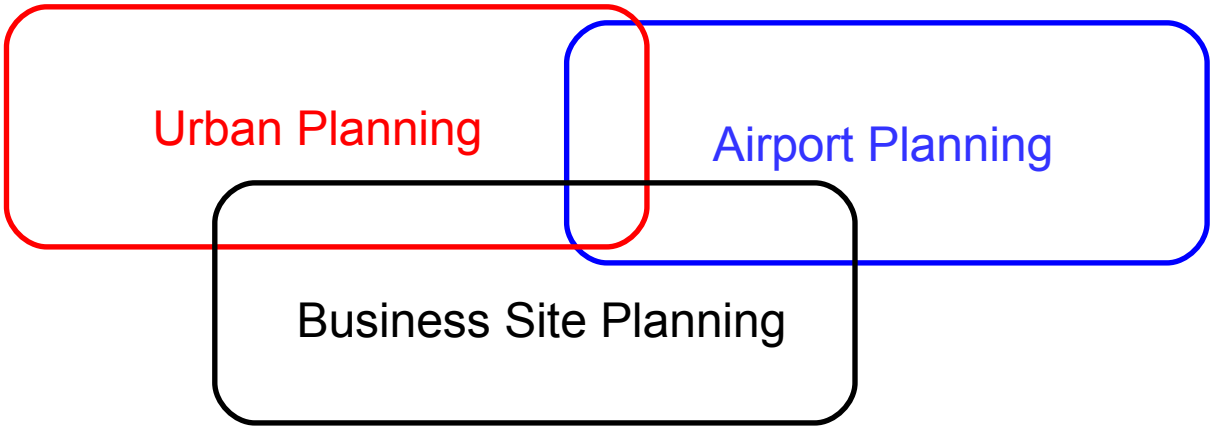


How will it get done?

Exhibit 4.2. Integrated Aerotropolis Planning

- Ground transportation planning
- Land use planning
- Environmental impact assessments

- Master planning
- Traffic generation
- Facility and infrastructure planning



- Investment planning and risk analysis
- Regional positioning and marketing
- Cluster analysis