

## Airport city developments in Australia Land use classification and analyses

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# **Airport city developments in Australia**

## **Land use classification and analyses**

**TRAIL Research School, Delft, October 2008**

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## **Abstract**

In recent years the Australian air transport industry has experienced unprecedented growth, driven by strong local and global economies. Whether this growth can continue in the face of anticipated oil crises and slowing international economic forecasts is yet to be seen. One thing is certain, airport owners and operators will continue to be faced with a challenging environment in which to do business. In response to these challenges, many airports are diversifying their revenue streams through landside property developments within the airport boundary. This phenomenon is recognised as the development of an 'airport city' and has the potential to ensure an airport's operating future, by means of improving an airport's profitability making it less susceptible to any downturns in the aviation industry.

Between 1997 and 2002 twenty-two of Australia's major airports were privatised under a 99 year lease arrangement with the Australian federal government. These leases have given control of all airport development to the lessee, with negligible regard to the planning intent of hinterland municipalities (providing the development complies with the *Airports Act 1996*). It is evident that Australia's airport city developments are in part focused on the provision of retail and commercial services for the surrounding population outside of any aeronautical function. It has been argued that these new developments have the capacity to impact the character and progress of local and municipal retail and commercial centres.

The primary purpose of this paper is to identify and categorise the on-airport development which has been occurring at the twenty-two Australian airports which are administered under the *Airports Act 1996*. The significance of this research is that it will quantify and compare the land area available for landside property development within these airports utilising a common nomenclature. This will allow for comparative analyses across airport type (Regular Passenger Transport (RPT), General Aviation (GA) and Pilot Training (PT)) in relation to the extent and range of development, in addition to allowing airport development intent to be reviewed in consideration of an airports passenger numbers and aircraft movements. This research will assist Australian and international airport and municipal planners in understanding the current extent and category of on-airport land use, allowing them to make better decisions when proposing development both within airport master plans and beyond the airport boundary in local town and municipal plans.

## **Keywords**

Australia, airport city, on-airport development, land use classification



# 1 Introduction

The term 'airport city' has been used to describe the growth of aeronautical and non-aeronautical land developments occurring at modern airports worldwide. In its purist form an airport city is the strategic expansion of on-site industrial, commercial and retail services and facilities at an airport, with the intention of servicing both the travelling public and the regional customer (Conway, 1993; Kasarda, 1996; Freathy and O'Connell, 1999; Stevens et al., 2007). Such expansion and diversification of services at airports is intended to reduce an airports sole reliance on the travelling public and broaden their revenue stream enabling them to be more resilient to volatility in the aviation industry. In Australia, this development may focus on the encouragement of aviation reliant and related industry, it may also provide for the industries of the new economy, or alternatively commercial and retail businesses and services that have limited reliance on air transport or aviation.

Several spatial models of airports as 'airport cities' are documented. The identification of the airport as a focus for logistics, and as a function of transport based urban development, has been recognised as an 'aerotropolis' (Kasarda, 1991). The 'airfront' (Blanton, 2004) is recognised as the collection of aviation related industries and services attracted to, and located within, the airport hinterland. While the 'aviapolis' (Finavia, 2004) is the marketing and development of an aviation orientated business hub, centred on an airport. Airports worldwide are increasingly functioning as activity centres of regional, national and international importance, focussed on developing the resources of the airport and the region. The 'airport city' is a centre that is able to offer desirable networks, strategic alliances, a variety of markets and the support of infrastructures necessary for trade and mobility, not unlike the central business district of a city.

Whilst these 'airport city' models exist there is very little empirical research into this changing role of the modern airport. Airport corporations, as private companies in Australia, are embracing the concept as strategic intent inducing a range of airport and regional land use impacts and opportunities, yet without explicit acknowledgment of the wider urban system. Land use both on and off the airport needs to be recognised in view of the issues that arise from the growth of airports as regional and national activity centres – airport cities. The need for compatible and coordinated land use is crucial to the discussion of airport and regional planning and whilst this fact is well documented its effective implementation is exceedingly difficult to establish (WAGG, 2004; Blanton, 2004; AOPA, 1999; DoT, 2002). Even when airports are owned and operated by the same government that controls surrounding land use, as is often the case in the United States and Europe, there is ongoing conflict. The situation is further complicated under the airport ownership structure in Australia where local and state government control of on-airport development is limited to consultative processes, and no mechanism exists for airport operator input into regional development. Airport and metropolitan land use planning has been occurring in isolation of one another, resulting in incompatible land use and development decisions both on-airport and in the surrounding region (Stevens et al., 2007). Local and municipal governments may consider airport commercial and retail development, which draws on the regional population, is conflicting with and restricting their strategic intentions, while airport operators may be alarmed at incompatible regional land use (May and Hill, 2006). Neither stakeholder is able to endorse, influence or



veto land use planning decisions of the other. It is for these reasons that new knowledge is required to ensure potential and opportunity for both the airport and the region is maximised through compatibility and certainty in land use. The following on-airport land use classification and analyses is part of a larger program of airport and regional research. However this preliminary investigation will begin to assist decision making by providing a national land use classification for airport development, and therein providing a means of comparative analysis and understanding across a range of airport contexts.

The paper is structured as follows: first, an overview of the current growth in the aviation industry in Australia is briefly covered; including a discussion of how airport ownership is structured in Australia. Secondly, we outline the method utilised to review the land use zoning at the Australian airports administered by the *Airports Act 1996*. This is followed by a discussion of the results for each airport investigated and the implications and intentions for future research.

## **2 Background**

What may be easily recognised in Australia is that airports are fast becoming major business centres, underpinned by various privatisation strategies. The Commonwealth government has leased large urban and regional airports to private corporations and syndicates, and since the late 1990s these entities have been well placed to benefit from the business and developer demand for airport-related and broader commercial development. In the process, airports have shifted from ‘public good’ transport interchange nodes to profit oriented commercial ventures where aviation revenue is now only a part of the airport ‘business’. As a result of such changes, a range of issues and impacts now pose considerable challenges for both the airport and the surrounding urban and regional environment.

### **2.1 Aviation growth in Australia**

In the 10 years from 1995 to 2005 passenger movements on domestic routes have increased in Australia by an annual average of 4.6%. Within the same time frame international passenger movements have increased by an annual average of 5.9%. Importantly in the three years from 2002 to 2005 domestic passenger movements have increased from 50 million to 68 million, representing an increase of 36%. Each day, well over 100,000 people fly from one Australian airport to another, and almost 50,000 more leave or enter the country by air (DOTARS, 2005).

Over the past decade the five major capital city airports in Australia have had significant increases in passenger movement. Sydney, Perth, Brisbane, Adelaide and Melbourne have had a cumulative growth of 55%: in 1997 the total volume of domestic and regional passengers was 52.7 million passengers; by the end of 2006 this increased to 81.7 million people (DOTARS, 2007). In addition it is easy to recognise the growing importance of airports as global gateways of low weight/high value and just on time trade. In 2003/04 while only 0.1% of Australia’s total international freight was carried by aircraft this equated to \$AUD65.5 billion worth of freight – some 26.4% of the total value (DOTARS, 2005). While this feature of the aviation industry provides obvious benefits to airport users, operators and providers, it

also presents potential new revenue streams for local industries and state/municipal governments.

## 2.2 Airport ownership in Australia

Since the end of World War II, there has been devolution of airport ownership both in Australia and internationally. In Australia, the Federal Airports Corporation (FAC) when formed in 1988 had responsibility for only seventeen airports. The FAC operated on commercial lines utilising the governance, management and incentive strategies of the private sector. The deregulation of the Australian domestic airline industry in 1990 when the *Airline Agreement (Termination) Act 1990* came into effect had a catalytic impact in making domestic air travel accessible to the broader public (Quiggin, 1997). Consequently, significant increases in airport revenue were generated in the prelude to full privatisation (Hooper et al., 2000; Graham, 2003). From 1996 FAC airports were put to tender in a two phase process under the provisions of the new *Airports Act 1996*. The Federal Government netted billions of dollars in the sale of airport leaseholds. Despite the Asian economic crisis at the time, the price earnings ratios for Australian airports were high because of limited opportunities to purchase international airports in the Asia Pacific region, the high degree of corporate autonomy bestowed, and the significant geographic monopoly power involved (Hooper et al., 2000). Airport operators purchased a wide range of development rights with no restriction on the type of land use other than compliance with the *Airports Act 1996*. The government sales team marketed the investment potential and opportunity for revenue from property development, car parking and commercial initiatives (Freestone et al., 2006).

The airports operated by the FAC were leased individually on 50-year terms with an option for a further 49 years, and were put to tender in a two phase process. The first phase, May 1997, involving the sale of Brisbane, Perth, and Melbourne airports; the second, March 1998, consisting of Adelaide, Parafield, Darwin, Alice Springs/Tenant Creek, Archerfield, Canberra, Coolangatta, Hobart, Jandakot, Launceston, Moorabbin and Townsville. Sydney's Kingsford Smith airport was withheld from both phases of sales due to unresolved noise issues and the ongoing debate about the establishment of a second Sydney airport at Badgerry's Creek. In 1998 Sydney Airport Corporation, a state owned entity was established to run the airport, and when plans for the second airport were scrapped it would appear the airport would be privatised. Events of 2001 such as the World Trade Centre attacks and the collapse of the Australian domestic carrier *Ansett*, again delayed the sale of the airport until June 2002, when a consortium headed by Macquarie Airports Group bought it for \$AUD5.6 billion, more than the combined total for all the other airports (Hooper et al., 2000).

The new operators of the airports are bound by the *Airports Act 1996*, in addition to Federal Government and international regulations that also control aviation. The objectives of the *Airports Act 1996* are defined as follows:

- to promote the sound development of civil aviation in Australia;
- to establish a system for the regulation of airports that has due regard to the interest of airport users and the general community;
- to promote the efficiency and economic development and operation of airports;
- to facilitate the comparison of airport performance in a transparent manner;

- to ensure majority Australian ownership of airports;
- to limit the ownership of airports by airlines;
- to ensure diversity of ownership and control of certain major airports; and
- to implement international obligations to airports.

In addition, the *Airports Act 1996* outlines the planning and development requirements for these airports through the use of airport master plans and major development plans.

### **2.3 Airport Planning under the *Airports Act 1996***

Two key features of the airport planning approvals process are master plans and major development plans. A master plan is a long-term land use plan for the whole of an airport site and deals with broader indicative intentions, rather than any detail on individual projects. The master plan is required, under the *Airports Act 1996*, to relate to a period of 20 years and it must be updated every five years (Freestone et al., 2006). The master plan is a strategic policy document setting out the airport's agenda for current and future airport management and development. Section 71 of the *Airports Act 1996* lists matters that must be included in a draft master plan for an airport, including the airport lessee company's assessment of future needs of civil aviation and other users of the airport for services and facilities. Under section 79, before submitting a draft master plan to the Federal Minister of the Department of Infrastructure, Transport, Regional Development and Local Government (the Minister), the airport must undertake a formal 90-day public consultation process. Details of the public consultation undertaken, submissions received and details of consultation undertaken by the airport lessee company prior to the formal public consultation period must be included in the draft master plan lodged with the Minister (ibid).

Approval of a master plan does not represent approval to build any specific major development referred to in the master plan. Major development applications must be separately approved. A separate major development plan (MDP) is required for each development that is defined as 'major' by section 89 of the *Airports Act 1996*. This is an extensive definition, and includes development such as constructing a new runway or extending an existing one; constructing a new building wholly or principally for use as a passenger terminal where the building's gross floor area is greater than 500m<sup>2</sup>; constructing a new building not used wholly or principally as a passenger terminal, whose construction cost exceeds \$AUD20 million; and development of a kind that is likely to have a significant environmental or ecological impact (Hooper et al., 2000). The MDP is required to be released for public comment, be consistent with the intent of the master plan and include an environmental impact assessment.

Any development on airports is only governed under the *Airports Act 1996*, and as such master plans and MDP's are submitted to the Federal Minister of the Department of Infrastructure, Transport, Regional Development and Local Government for approval. That is, Australian airport lessee companies are not required to have due regard to local or state planning regulations. Section 112 of the *Airports Act 1996* specifically excludes state laws from applying in relation to land use planning and building activities. It is this fact that has been the source of on-going airport and

regional conflict regarding the expansion of retail and commercial development of airport land.

## **2.4 Diversification of airport revenue**

Airport privatisation was primarily an opportunity to unburden the nation from public sector funding of airport development. It has resulted in airport operators wanting highest returns on their investment, and they have been quick to outline expectations for the capitalisation of their land assets in the legislatively required master planning process. Airport corporations recognise that they cannot survive by landing planes, and need to diversify their commercial interests as means of ensuring profitability. For example, net profit margin for the 50 leading global airport groups in 2001 was 11%. The 50 major airlines were -4% in the same period (Graham, 2003).

In many models of 'airport city' development (Kasarda, 1991; Conway, 1993; Blanton, 2004) landside developments are more often a product of the function of the airport, seeking to internalise the development to assist and encourage the exploitation of the airport and its aeronautical function. This is generally not the case in the Australian context, where the land side developments are looking externally, beyond the airport perimeter for customers, drawing in a regional catchment of new consumers at the airport.

In Australia, the development of business and technology parks and retail complexes is a preferred commercial strategy at airports where suitable land assets exist, and where landside access infrastructure will allow such development. Although it may be recognised that even without accounting for accessibility, a growing number of regionally focussed airport retail districts are gaining popularity at Australian airports (SGS, 2003). It has been argued that this type of on-airport expansion has the potential to impact on the viability of urban centre retailing through the diversion of expenditure, often away from city planned and intended centres of employment and commerce (FCA, 2005). Such development is typified by the provision of hardware stores and 'direct factory outlets' or a range of retail, clothing, electronics, and speciality stores which one would expect to find within regional centres. Some airports are also developing supermarkets, and taverns (hotels), significantly away from, and with limited access to, the aviation function of the airport.

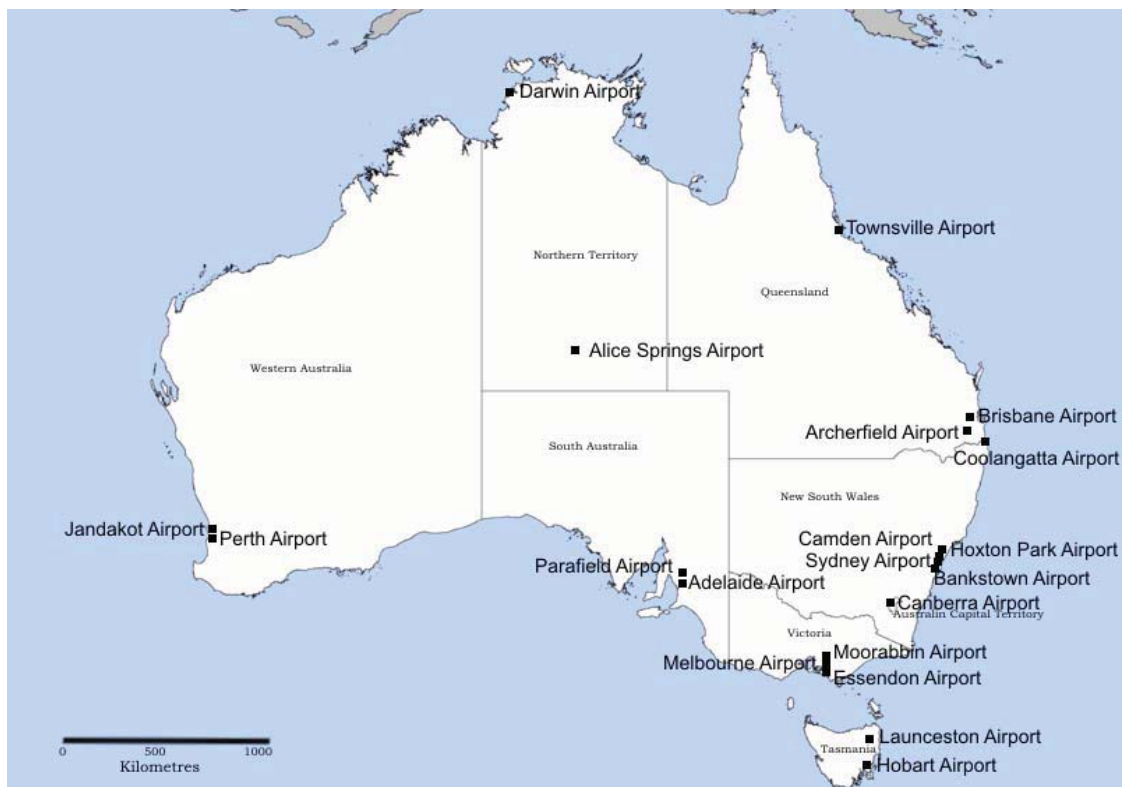
A different set of airport and regional operating environments are created when airports draw on regional catchments of non-travelling public to generate an increasing proportion of commercial revenue. These regional commercial strategies are recognised as having the potential to imperil airport access as transport connections are increasingly congested with retail and commercial traffic (MIC 1999; SGS 2003). In Australia, an improved understanding of current and intended on-airport land use is necessary if airport and municipal planners are to advance cooperative and compatible development.

## **3 Land use analysis: methods and materials**

This section will discuss the rationale of selecting the airports in the study group, and the process utilised to produce the airport land use zoning maps and subsequent spatial analysis.

### 3.1 Airport study group

Twenty-two Australian airports are administered under the *Airports Act 1996*; of these twenty must comply with part 5 of the *Airports Act 1996* and produce a master plan which includes land use zoning information. These airports have been deemed significant to the nation and were chosen as the airports of interest for this paper (Figure 1). All of these airports operate under a leased ownership arrangement. This research will indicate if the private companies that leased these airports have indeed engaged or are intending to engage in property development and to what extent. The airports included in the study are listed in Table 1. Three types of airports were identified in the study group; Regular Passenger Transport (RPT), General Aviation (GA) and Pilot Training (PT) airports. Unfortunately passenger and freight data was not available for all airports listed, however aircraft movement data was available for the entire study group. Table 1 also displays the airport property area in hectares and lists the airport owner information.



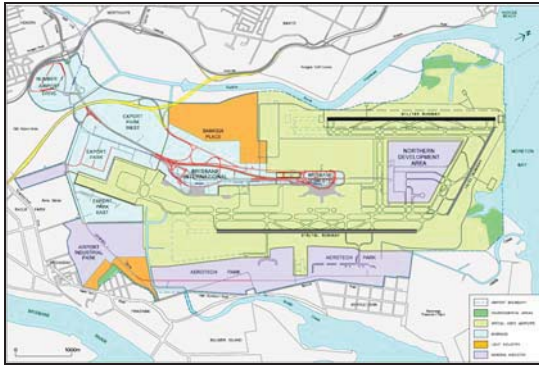
**Figure 1: Study group within Australia**

**Table 1: Airport study group**

| Airport       | Code | Type    | Passenger movements 2006- 2007 | Aircraft movements 2006 – 2007 | Freight movements 2006- 2007 (tonnes) | Airport Property Area (hectares) | Owner                                   |
|---------------|------|---------|--------------------------------|--------------------------------|---------------------------------------|----------------------------------|---|
| Adelaide      | ADL  | RPT     | 6,181,390                      | 103,028                        | 18,668                                | 785                              | Adelaide Airport Ltd                    |
| Alice Springs | ASP  | GA      | 624,326                        | 22,692                         | NA                                    | 3550                             | Northern Territory Airports Pty Ltd     |
| Archerfield   | YBAF | GA & PT | NA                             | 119,644                        | NA                                    | 259                              | Archerfield Airport Corporation Pty Ltd |
| Bankstown     | BWU  | GA & PT | NA                             | 329,550                        | NA                                    | 313                              | Bankstown Airport Limited               |
| Brisbane      | BNE  | RPT     | 17,379,809                     | 169,296                        | 88,575                                | 2700                             | Brisbane Airport Corporation            |
| Camden        | CDU  | GA & PT | NA                             | 10,190                         | NA                                    | 194                              | Camden Airport Limited                  |
| Canberra      | CBR  | RPT     | 2,687,336                      | 78,484                         | NA                                    | 436                              | Capital Airport Group Pty Ltd           |
| Coolangatta   | OOL  | RPT     | 3,777,856                      | 68,416                         | 2                                     | 365                              | Queensland Airports Pty Ltd             |
| Darwin        | DRW  | RPT     | 1,403,685                      | 87,632                         | 327                                   | 1540                             | Northern Territory Airports Pty Ltd     |
| Essendon      | MEB  | GA & PT | 6,883                          | 56,784                         | NA                                    | 305                              | Essendon Airport Pty Ltd                |
| Hobart        | HBA  | RPT     | 1,629,417                      | 29,978                         | NA                                    | 499                              | Hobart International Airport Pty Ltd    |
| Hoxton Park   | YHOX | GA      | NA                             | 40,000                         | NA                                    | 87                               | Hoxton Park Airport Limited             |
| Jandakot      | JAD  | GA & PT | NA                             | 387,722                        | NA                                    | 622                              | Jandakot Airport Holdings Pty Ltd       |
| Launceston    | LST  | GA & PT | 995,664                        | 20,322                         | NA                                    | 180                              | Australia Pacific Airports Corporation  |
| Melbourne     | MEL  | RPT     | 22,156,871                     | 180,814                        | 203,505                               | 2647                             | Australia Pacific Airports Corporation  |
| Moorabbin     | MBW  | GA & PT | 8,676                          | 276,146                        | NA                                    | 294                              | Moorabbin Airport Corporation           |
| Parafield     | ADZ  | GA & PT | NA                             | 227,910                        | NA                                    | 437                              | Parafield Airport Ltd                   |
| Perth         | PER  | RPT     | 7,977,091                      | 103,976                        | 64,786                                | 2105                             | Westralia Airports Corporation Pty Ltd  |
| Sydney        | SYD  | RPT     | 31,016,186                     | 286,342                        | 369,956                               | 905                              | Macquarie Airports Group                |
| Townsville    | TSV  | RPT     | 1,271,649                      | 60,612                         | NA                                    | 937                              | Queensland Airports Pty Ltd             |

### 3.2 Spatial analysis process utilised to create land use zoning maps

The land use zoning information was obtained from twenty airport master plans submitted to the Australian government as required by the *Airports Act 1996*. These documents are freely available on the Internet at each airport's respective website. Unfortunately the land use zoning information could only be obtained as raster images without any geo-referencing information (BNE zoning is shown in Figure 2). Consequently, the first step was to geo-reference the land use zoning information in a geographic information system (GIS). Once geo-referenced the raster images were converted into polygon feature classes (converted BNE zoning is shown in Figure 10). This was achieved by manually digitising each of the land use zones to create separate polygons in the feature class. The attributes for each polygon contained the original land use zone information obtained from the master plan image. The use of a manual digitising process was feasible as the number of airports in the study group was small.



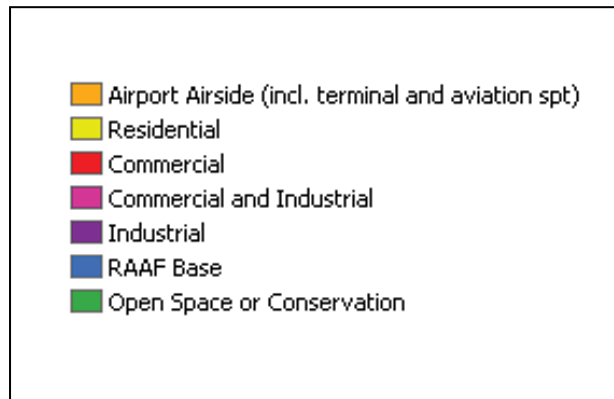
**Figure 2: Brisbane Airport (BNE) land use zoning**

### 3.3 Re-classification of land use zoning

Whilst the *Airports Act 1996* seeks to ensure a common planning language between airport master plans and their municipal regions, no such land use zoning nomenclature exists nationally. It was therefore necessary to re-classify the inconsistent airport master plan zoning into a common set of zoning categories. Without such a re-classification the comparison of the respective land use zones would be impossible. The descriptions of the re-classified zoning categories are shown in Table 2, whilst the colour representations are depicted in Figure 3.

**Table 2: Zoning categories**

| Zoning Category                                   | Description  |
|---|--|
| Residential                                       | Predominant use is housing.  |
| Commercial  | Retail, business, community, leisure, entertainment, recreation, hotels, conference facilities, shopping centres, (i.e., will mostly be non- aeronautical) |
| Industrial  | Warehouses, freight, manufacturing, service oriented businesses, (can be either aeronautical or non-aeronautical)  |
| Commercial and Industrial                         | Mix use commercial and industrial.   |
| Open Space & Conservation                         | Open areas, nature based recreation areas, protected areas.  |
| RAAF Base   | Military airbase of the Royal Australian Air Force (RAAF). The Australian Department of Defence has planning and control of this area.                     |
| Airport Airside (incl. terminal and aviation spt) | Aviation operational areas, terminal and aviation support areas.   |



**Figure 3: Land use zoning legend**

The final step of the process was to calculate the percentage of total area for each zoning category. The polygon feature class used automatically calculates polygon areas as they are digitised. A simple GIS attribute query was written to calculate the percentages from this information. The resulting percentages are shown in Table 3..

**Table 3: Airport land use zoning percentages**

| Land Use Zoning                                   | ADL       | ASP       | YBAF      | BWU       | BNE       | CDU      | CBR       | OOL       | DRW      | MEB       | HBA       | YHOX      | JAD       | LST      | MEL       | MBW       | ADZ       | PER       | SYD       | TSV      | Average      | Standard Dev ( $\sigma$ ) |      |
|---|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|----------|--------------|---------------------------|------|
| Residential                                       | 0         | 11        | 0         | 0         | 0         | 0        | 0         | 0         | 0        | 0         | 0         | 0         | 0         | 0        | 0         | 0         | 0         | 0         | 0         | 0        | 0            | 0.55                      | 2.4  |
| Commercial  | 17        | 4         | 0         | 16        | 20        | 5        | 18        | 18        | 4        | 23        | 0         | 0         | 25        | 2        | 7         | 7         | 15        | 3         | 3         | 0        | 0            | 9.35                      | 8.4  |
| Commercial and Industrial                         | 13        | 0         | 37        | 35        | 25        | 2        | 37        | 0         | 0        | 16        | 34        | 13        | 0         | 0        | 10        | 52        | 8         | 30        | 8         | 7        | 0            | 16.35                     | 15.6 |
| Industrial  | 0         | 4         | 6         | 0         | 0         | 0        | 0         | 11        | 1        | 0         | 0         | 0         | 0         | 5        | 7         | 0         | 17        | 0         | 3         | 0        | 0            | 2.7                       | 4.5  |
| <i>Landside Development subtotal</i>              | <i>30</i> | <i>19</i> | <i>43</i> | <i>51</i> | <i>45</i> | <i>7</i> | <i>55</i> | <i>29</i> | <i>5</i> | <i>39</i> | <i>34</i> | <i>13</i> | <i>25</i> | <i>7</i> | <i>24</i> | <i>59</i> | <i>40</i> | <i>33</i> | <i>14</i> | <i>7</i> | <i>28.95</i> | <i>16.5</i>               |      |
| Open Space and Conservation                       | 13        | 65        | 2         | 4         | 2         | 25       | 0         | 25        | 3        | 0         | 20        | 27        | 37        | 0        | 21        | 0         | 9         | 14        | 4         | 0        | 0            | 13.55                     | 16.2 |
| RAAF Base   | 0         | 0         | 0         | 0         | 0         | 0        | 0         | 0         | 78       | 0         | 0         | 0         | 0         | 0        | 0         | 0         | 0         | 0         | 0         | 91       | 0            | 8.45                      | 25.4 |
| Airport Airside (incl. terminal and aviation spt) | 57        | 16        | 55        | 45        | 53        | 68       | 45        | 46        | 14       | 61        | 46        | 60        | 38        | 93       | 55        | 41        | 51        | 53        | 82        | 2        | 0            | 49.05                     | 20.7 |

## 4 Results and discussion

This section presents the results of the spatial analysis of the land use zoning data. First the overall group result will be discussed and subsequently each airport in the study group will be presented and discussed in turn. The total land use zoning percentages for each airport are summarised in Table 3. The landside development subtotal is the sum of all residential, commercial and industrial development and is shown as the *italicised* values (shaded row) in Table 3. This subtotal is significant as it represents the proportion of land zoned for on-airport property development (i.e., aeronautical or non- aeronautical). The land use zoning maps for all airports are

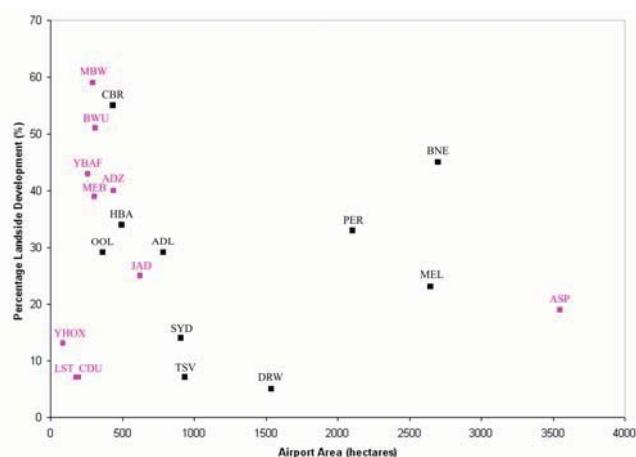
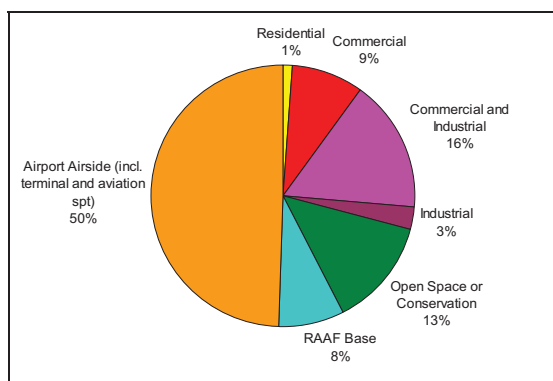


shown in Figures 6 to 25. All these maps are presented using a common scale (1:40,000) in order to show the relative airport property sizes.

The average percentages for the land use zoning categories for the study area (the right-hand column in Table 3) are shown as pie chart in Figure 4. On average, 50% of the airport is utilised for airside activities, 8% for Defence uses, 13% for open spaces and 29% for landside development activities. In addition the standard deviation was calculated for each zoning category, so as the measure of dispersion could be calculated and discussed for each airport (Table3).

In an attempt to discover relationships between landside development and airport area a scatter plot was produced to compare these two variables. Figure 5 shows the resulting scatter plot. Alice Springs Airport (ASP) (having the largest area) can be seen at the far right and Moorabbin Airport (MBW) is shown in the top left with the largest landside development percentage. From this figure it is apparent that no strong relationship exists between airport area and landside development percentage. For example, BNE and YBAF have very similar proportions of landside development but totally different airport areas. A similar method was used to evaluate landside development percentage against both the number of passengers and aircraft movements at each airport. From these investigations, no clear correlation between variables became apparent.

This result although disappointing was not unexpected. The urban environment has many complex variables and factors which govern the space in which development can and will occur. Therefore it is naïve to think that only variables on airport property would have an affect on landside development zoning. It is highly probably that there is a combination of airport and surrounding urban development factors that are contributing to the proportion of landside development zoning and the discovery of these factors is intended for future research.



**Figure 4: Land use zoning percentages**

**Figure 5: Landside development vs. airport area**

In the following analysis of the study group particular aspects of each airports development will be presented in turn. The paper will discuss the comparative

percentages of landside development (shaded row Table 3) in addition to presenting the number of standard deviations this figure represents from the mean. The standard deviation is a measure of the dispersion of the values. It is defined as the root-mean-square (RMS) deviation of the values from their mean. If many data points are close to the mean, then the standard deviation is small; if many data points are far from the mean, then the standard deviation is large. If all data values are equal, then the standard deviation is zero.

This analysis will offer an indication of an airport's development in consideration of the group providing a better suggestion of how the airports actual and intended on-airport development fits within the national profile. This information may be considered useful when evaluating the scope and scale of on-airport development between the different types of airports in the study group; Regular Passenger Transport (RPT), General Aviation (GA) and Pilot Training (PT) airports. Further detailed analyses may be undertaken utilising this method, however for the purposes of this paper only landside development has presented.

#### 4.1 Adelaide Airport (ADL) - RPT

Adelaide Airport has 30% of its available land zoned for landside development and 57% for airside development (Table 3). The land zoned for landside development represents an  $x$  value of 0.063 away from the standard deviation of 16.5, indicating a value very close to the mean for the study group. The airside development  $x$  value of 0.38, away from the standard deviation indicates an airside area marginally above the mean for the group. The landside proportion is consistent with the group and shows the extent to which Adelaide Airport intends to pursue its commercial development strategy. The land use zoning for ADL is shown in Figure 6 and the development within these areas is well established. Adelaide Airport has opened two major retail facilities in recent years, a Harbour Town factory outlets centre and an IKEA store, in addition to completing a major upgrade of its terminal facilities that has incorporated an expanded airside retail area occupying around 3400sqm.

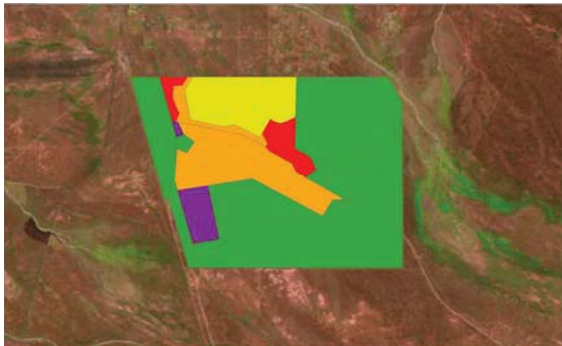
Adelaide Airport is currently working on expanding the Harbour Town complex, adding a further 18 brand outlets, and a supermarket to serve surrounding residents and airport employees. The proposed extension would add an estimated 4000sqm of brand outlet floor space and 3900sqm of supermarket floor space with construction expected to be complete in late 2008.



**Figure 6: Land use zoning Adelaide Airport (ADL)**

## 4.2 Alice Springs Airport (ASP) - GA

Alice Springs Airport is the largest in Australia in terms of land area with approximately 3,550 hectares as shown in Figure 7 and Table 1. In establishing the original airport site, a large area of land within the boundary was set aside to ensure dust suppression and therein operational safety. Consequently a large part of Alice Springs Airport is unsuitable for development. Longer-term development will be restricted to the north side of the runway, whilst land to the south continues to provide dust suppression. Within the available area, Alice Springs Airport has zoned 19% for landside development as shown in Table 3. This represents an  $x$  value of  $-0.60$  away from the standard deviation, indicating that the airports landside proportion is below average for the study group but given the environmental constraints low demand for development it is still significant. Alice Springs is the only airport in the study group to have zoned an area for residential development. In fact 11% has been zoned residential to the north of the property, which is a very significant  $x$  value of  $4.16$  standard deviations from the mean. This unique strategy has not result in any residential development being constructed at this stage.



**Figure 7: Land use zoning Alice Springs Airport (ASP)**

## 4.3 Archerfield Airport (YBAF) – GA/PT

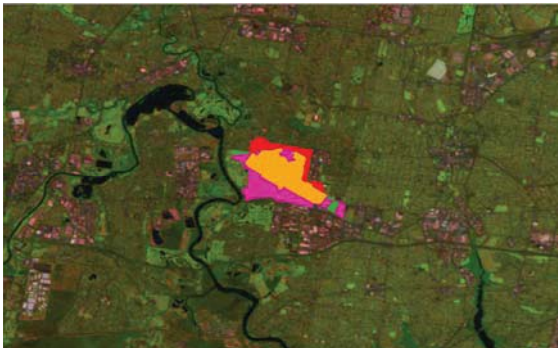
Archerfield Airport is situated in one of Brisbane's fastest growing industrial areas and as a result has zoned 43% of its available land to landside development (See Table 3). This proportion of land represents an  $x$  value of  $0.85$  standard deviations above the mean, and whilst not the largest value of the group is consistent with the land side development intentions of mixed General Aviation (GA)/ Pilot Training (PT) airports. There is over 75 hectares of undeveloped land on the Airport that is intended to be developed for aeronautical and non- aeronautical purposes as shown in Figure 8. Archerfield Airport's master plan states that this area is intended for commercial and industrial development and will be progressively developed to underpin the viability of the airport (AAC, 2005).



**Figure 8: Land use zoning Archerfield Airport (YBAF)**

#### **4.4 Bankstown Airport (BWU) – GA/PT**

Bankstown Airport is very similar to Archerfield Airport both in size and in their development philosophy, however with significantly more aircraft movements. Bankstown Airport consists of 313 hectares of land and is approximately 30 minutes drive to Sydney's Kingsford Smith Airport, Sydney CBD and Port Botany via the M5 Motorway. The proportion of landside development is above average at 51%, representing a significant  $x$  value of 1.34 standard deviations from the mean. The land use zoning and master plan intention is for a wide variety of uses from light industrial activities to manufacturing and logistics and is shown in Figure 9. Three separate precincts are planned providing dedicated employment land, industrial facilities and business space. The northern precinct is currently home to the majority of Bankstown Airport's tenants.



**Figure 9: Land use zoning Bankstown Airport (BWU)**

#### **4.5 Brisbane Airport (BNE) - RPT**

Brisbane Airport has the second largest airport property size in Australia (2700 hectares) as shown in Figure 10. The land use zonings for Brisbane Airport are shown in Figure 10. From Table 3, it can be seen that landside development has the potential to occupy 45% of the total airport area, representing an  $x$  value of 0.97 standard deviations from the mean, placing it within the group of airports with the largest areas designated for landside development. Brisbane airport is well advanced with regard to its on-airport development, including retail facilities such as the Direct Factory Outlet and Woolworths supermarket. Brisbane Airport Corporation Limited acquired Brisbane Airport in 1997. Its vision is to turn a city airport into an 'airport city' consisting of seven integrated precincts that together will provide a 1000 hectare,

24 hour global trade and commerce centre, attracting business, jobs and prosperity to Queensland (BAC, 2005). Currently approximately 320 businesses and nearly 16,000 people work on Brisbane Airport every day. This is forecast to increase to 42,500 people by 2023.



**Figure 10: Land use zoning Brisbane Airport (BNE)**

#### **4.6 Camden Airport (CDU) - GA**

Camden is a small GA airport of 194 hectares as shown in Table 1. The land use zonings for Camden Airport are shown in Figure 11. From this image it may be seen that Camden Airport is surrounded on three sides by a river which limits its potential for landside development. Consequently Camden Airport's proportion of landside development is low at only 7%, representing an  $x$  value of -1.33 standard deviations below the mean. This is a significant value, when considering the general landside development intentions, and  $x$  values of other GA and PT airports. The existing businesses at Camden Airport are few and mainly related to supporting general aviation at the airport.

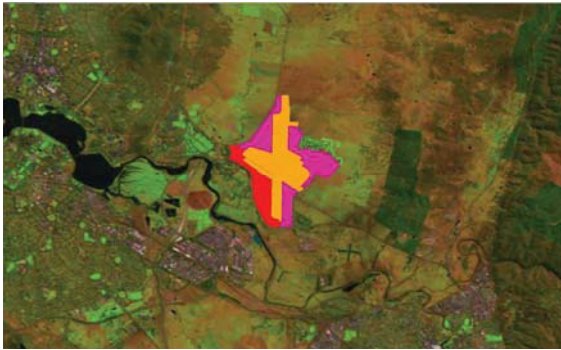


**Figure 11: Land use zoning Camden Airport (CDU)**

#### **4.7 Canberra Airport (CBR) - RPT**

The land use zoning categorisations for Canberra Airport are shown in Figure 12. At 55%, Canberra Airport has the second largest proportion zoned for landside development, representing a significant  $x$  value of 1.58 standard deviations above the mean. Canberra airport has divided the airport into four major precincts: South East, South West, North East, and North West. The terminal facilities and Brindabella Business Park are located within the South West precinct. Since the change of ownership in 1998 Canberra Airport has undergone significant rebuilding of the

airport's infrastructure with a \$AUD250 million terminal upgrade and runway extension, together with the simultaneous construction of the Brindabella Business Park, including 20,000sqm of new office space. The number of airport businesses has grown from 70 to 115 and the number of jobs has almost doubled from 1,660 to 3,100. More recently the landside development of the North West precinct has seen the inclusion of 'out of town' retailing in the form of a Brand Depot complex which incorporates over 70 retail 'factory' outlets and 1,700 free car parks.



**Figure 12: Land use zoning Canberra Airport (CBR)**

#### **4.8 Coolangatta Airport (OOL) - RPT**

Coolangatta Airport is home to one of the last remaining development land banks on the Gold and Tweed Coasts (Figure 13). The airport has 365 hectares of land and five precincts have been identified for development within the master plan. Coolangatta Airport is serviced by air, road and soon to be completed rail transport making it a prime location for the establishment of logistics based companies. Coolangatta Airport has 29% of its total airport area zoned for land side development, resulting in an  $x$  value of 0.03 standard deviations from the mean, representing a development area consistent with the standard of national study group.



**Figure 13: Land use zoning Coolangatta Airport (OOL)**

#### **4.9 Darwin Airport (DRW) - RPT**

Darwin Airport has 1540 hectares (see Table 1) of which 324 hectares is controlled by Northern Territory Airports Pty Ltd and the remainder controlled by Department of Defence as Royal Australian Air Force base, reducing the amount of land available for development. The land use zoning categorisation for Darwin Airport is illustrated in Figure 14. Darwin has only 5% (Table 3) of total land area zoned for landside

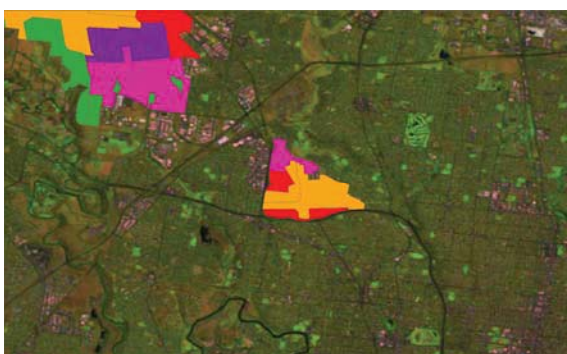
development, a significant  $x$  value of -1.45 standard deviations below the national study group mean. Darwin Airport has recently negotiated an agreement with the retail developer, Ticor Developments Pty Ltd, to build a \$AUD100 million 45,000sqm home and lifestyle retail centre at the airport's 87ha business park. This business park opened in 2006 with a 14,000sqm Bunnings Warehouse hardware store as the anchor tenant.



**Figure 14: Land use zoning Darwin Airport (DRW)**

#### **4.10 Essendon Airport (MEB) - GA/PT**

Essendon Airport is within close proximity to Melbourne Airport as illustrated in Figure 15 (Melbourne airport is the coloured area in the upper left of Figure 15). Essendon Airport has a higher than normal proportion (39%) of land zoned for landside development, with an  $x$  value of 0.61 standard deviations above the mean. This  $x$  value however is low in comparison to the landside development areas of other GA and PT airports (Table 3). The current landside developments include approximately 125 tenants utilising various offices, warehouse and storage. A 'Direct Factory Outlet' with bulky retail and a supermarket are situated in the Southeast of the airport. At 305 hectares, Essendon Airport may be considered an example of a small airport adopting a regional retail focussed development philosophy.



**Figure 15: Land use zoning Essendon (MEB)**

#### **4.11 Hobart Airport (HBA) - RPT**

Hobart Airport has zoned 34% of its 499ha of land for landside development. This figure is marginally above average for the study group (Table 3) and represents an  $x$  value of 0.3 standard deviations from the mean. Hobart Airport plans to add around 40,000sqm of regionally focused retail space with a 50-store Factory Outlet complex

and a bulky goods centre in the North Western development zone (Figure 16). This development plan gained federal government planning approval in 2007, after reducing the size of the original proposal and is expected to be completed in 2009.



**Figure 16: Land use zoning Hobart Airport (HBA)**

#### **4.12 Hoxton Park Airport (YHOX) - GA**

Hoxton Park Airport is the smallest airport in the group at only 87 hectares (Table 1); however the airport has designated 13% of this land for landside development (Table 3), resulting in an  $x$  value of -0.96 standard deviations below the mean. This development area is located in the Western part of the property as shown in Figure 17. The primary aim of their development intention is to facilitate a wide range of activities both aeronautical to non-aeronautical to capitalise on the limited land assets they possess. In review of their master plan Hoxton Park Airport may be considered a leading example of a very small airport with a clear landside development strategy.



**Figure 17: Land use zoning Hoxton Park Airport (YHOX)**

#### **4.13 Jandakot Airport (JAD) - GA/PT**

As shown in Table 1, Jandakot Airport is the busiest Australian airport in terms of aircraft movements. Jandakot Airport is a major pilot training facility and is situated on 622 hectares. A large area to the north west of the terminals has been zoned for commercial development as shown in Figure 18. This area represents 25% of the area of Jandakot Airport (Table 3), slightly below the study group's average for landside development, and represents an  $x$  value of -0.24 standard deviations below the mean. Despite the airports ongoing use as an important PT airport, it has also focussed primarily on a non aeronautical regional retail strategy. The development area is



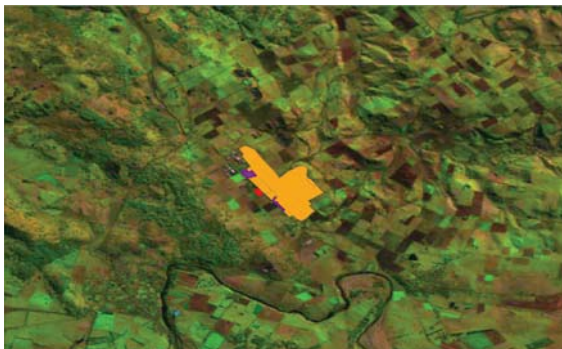
known as ‘Jandakot City’ and a number of offices and commercial buildings have been built there since 2006, including a retail homemaker and bulky goods centre.



**Figure 18: Land use zoning Jandakot Airport (JAD)**

#### **4.14 Launceston Airport (LST) - GA/PT**

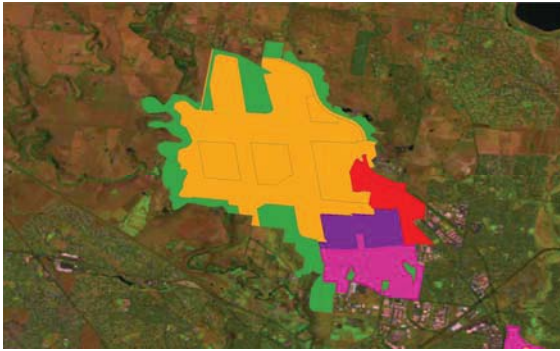
Launceston Airport is the second smallest airport in the group with only 180 hectares of land as shown in Table 1 and Figure 19. All the land to the East is required for aviation, aviation support and operational services uses. A smaller than average proportion of 7%, an  $x$  value of -1.33 standard deviations from the mean, has been zoned for landside development. This equates to an area of 2.8 hectares proposed for commercial uses however this area remains undeveloped at this time.



**Figure 19: Land use zoning Launceston Airport (LST)**

#### **4.15 Melbourne Airport (MEL) - RPT**

Melbourne Airport has the third largest airport area of 2647 hectares (Table 1). As indicated in Table 3 Melbourne Airport has zoned 24% of its property for landside development, an  $x$  value of -0.3 standard deviations below the mean. The landside development is located in the south eastern corner of the property as illustrated in Figure 20. Melbourne Airport is currently investing in an upgrade of its international terminals, spending \$AUD330 million over the next five years. A new passenger concourse of 7000sqm is part of the project along with an entire new international passenger precinct that will add more than 5000sqm of new airside passenger lounge, café, duty free and specialty shop space by 2011. With regard to its landside developments Melbourne Airport has recently gained federal government planning approval to build a 48,000sqm retail centre including bulky goods retailers and a supermarket.



**Figure 20: Land use zoning Melbourne Airport (MEL)**

#### **4.16 Moorabbin Airport (MBW) - GA/PT**

Moorabbin Airport has the largest percentage of land zoned for landside development with 59% (Table 3) this figure represents an  $x$  value of 1.82 standard deviations above the mean and is consistent with  $x$  values of GA and PT airport within the study group. It is one of the smallest airports in terms of land size (294 hectares) but is the fourth busiest in terms of aircraft movements (Table 1). As shown in Figure 21 the development zones spread North, South, East and West to maximise the available land. In the Northwest of the airport site is an existing retail activity node with associated car parking. The Chifley Industry Park is situated in the Northeastern area. On the Eastern and South periphery of the airport land a restaurant; landscape garden suppliers and timber sales; Kingston Golf Course and a service station are located. All these existing activities illustrate the maturity of the landside development at Moorabbin Airport and their master plan intent to capitalise on their land assets for regional retail purposes.

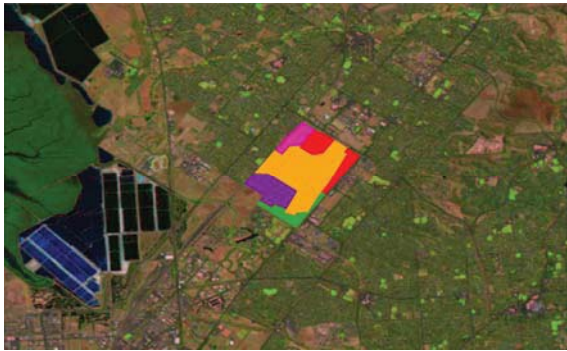


**Figure 21: Land use zoning Moorabbin Airport (MBW)**

#### **4.17 Parafield Airport (ADZ) - GA/PT**

Parafield Airport is a GA and PT airport operated by Adelaide Airports Limited, the airport lessee company for Adelaide Airport. As shown in Table 3, Parafield Airport has 40% of its land zoned for landside development, an  $x$  value of 0.67 standard deviations above the mean. The main building area, covering 20 hectares is located in the Northern region of the airport, and primarily accommodates commercial lease properties. The facilities include aircraft hangars, workshops, student accommodation, flying schools and a range of non-aeronautical facilities (e.g. clubs, sporting/recreational reserves), with the control tower located on the Southern

boundary. The commercial estate is the most recently developed precinct of the airport, providing approximately 17 hectares of serviced commercial land in the north-east corner of the airport as shown Figure 22.



**Figure 22: Land use zoning Parafield Airport (ADZ)**

#### **4.18 Perth Airport (PER) - RPT**

The land use zoning of Perth Airport is shown in Figure 23 and as Table 3 indicates a landside area of 33% is available for development from a site total of 2,105 hectares, representing an  $x$  value of 0.24 standard deviations from the study group mean. To date Perth Airport's business park has extensive warehouse and distribution facilities with Coles and Woolworths (retail food companies) both estate tenants. Additionally Perth Airport is home to BCG Pty Ltd Brickworks a facility with the ability to produce 110 million standard brick equivalents annually. This controversial non-aeronautical development occupies 30 hectares and received over 260 public submissions during its initial consultation phase in 2006.

The Perth Airport is currently reviewing development options with passenger numbers last year up 1 million on 2006 to 8 million. In addition Perth is currently upgrading a domestic terminal which is expected to provide an opportunity to add further airside retail.



**Figure 23: Land use zoning Perth Airport (PER)**

#### 4.19 Sydney Airport (SYD) - RPT

Sydney Airport, Australia's busiest airport is an example of an airport that has little available land for non-aeronautical related development. The airport is situated on 905 hectares of which 14% has been zoned for landside development (Table 3), an  $x$  value of -0.91 standard deviations below the mean. The land use zoning for Sydney Airport reveals that the only major land allocated for commercial development is in the southeast of the property (Figure 24). Sydney Airport has been unsuccessful in obtaining approval from the federal government to develop this land and consequently it remains mostly unimproved at his stage.

Sydney Airport has embarked on a terminal redevelopment that encompasses the creation of an airside and landside shopping environment presenting a range of restaurants, specialty stores and general retail. The project will increase the current three food and beverage outlets to nine and extend the existing 17 specialty retail outlets in the terminal to 42. The \$AUD500 million upgrade of the terminal, which is expected to be completed in 2009, will see both airside and landside offer 26 food and beverage outlets and 56 specialty stores. Indeed the popularity of shopping at Sydney Airport has made the retail precinct of Sydney Airport Terminal 1 one of the largest shopping centres by turnover in the Sydney metropolitan region.



Figure 24: Land use zoning Sydney Airport (SYD)

#### 4.20 Townsville Airport (TSV) - RPT

Townsville Airport operates under a joint user agreement with the Department of Defence and leases 81 hectares of the airport for civil aviation purposes. The remaining 856 hectares are utilised by the Royal Australian Air Force (RAAF) as shown in Figure 25. As a joint user facility, the responsibility for planning and development of Townsville Airport is shared by both the Department of Defence and Queensland Airports Pty Ltd. From Table 3 it may be seen that the defence use of the airport occupies 91% of total use, with only 7% available for landside development, representing a significantly low  $x$  value of -1.33 standard deviations below the mean. Despite the relatively limited space Townsville Airport is home to Australia's newest aviation business park, the Northern Australian Aerospace Centre of Excellence (NAACEX): a high security, fully serviced aerospace and aviation support precinct and business park. NAACEX will provide a cluster of aerospace and aviation support industries (both commercial and defence) servicing Australia and the South East Asia-Pacific region (QAL, 2007).



**Figure 25: Land use zoning Townsville Airport (TSV)**

## 5 Conclusion

In Australia it would appear that the amount of land being zoned for landside development has no relation to an airport's size (both in terms of property area and in terms of passenger or freight movements). In fact, the strategy to diversify revenue at Australian airports has resulted in a spate of development activity on airport property. All of the airports in the study group have zoned their land assets with capitalisation of landside development in mind and therein to some extent have embraced the 'airport city' concept.

In Australia, there is a perceived disjunction between the airside operations of many airports and the kinds of development being proposed and established within their boundaries. It would appear that a number of the airports studied have adopted a development strategy which focuses on offering retail goods and services for the regional consumer as a means of providing the desired alternate revenue stream. It is this type of Federally approved development that is at the core of airport operator and municipal conflict over the establishment of competing retail centres. The medium to long term implications for such development is yet to be established, but what is certain is the continuing discourse between the airport and the region will limit the establishment of cooperative strategies of 'airport city' development in the manner of the spatial models discussed.

This work is the first step in providing a clearer understanding of the development intentions of airport operators in Australia, utilising a common land use planning nomenclature. This lack of national consistency regarding Australian airport master planning was one of the foci of a recently released issues paper for the development of an Australian National Aviation Policy Statement by the Federal Department of Infrastructure, Transport, Regional Development and Local Government. By establishing a comparative platform for the analysis of on-airport development both airport and municipal planners may begin to recognise where and how their airport and region fits into the dialogue surrounding land use compatibility. In addition, through the classification of airport operations (RPT, GA, PT) and the analysis of their development intentions, the relationships between aeronautical function and on-airport land use may be better understood. This work will assist both national and international airport and municipal planners in recognising the extent, and type of, actual and proposed on-airport land use in Australia. This will establish a national

reference for decision making when proposing development both within airport master plans and beyond the airport boundary in local town and regional plans.

Analyses at this scale can only make assumptions about the relationships between the different zoning categories. Further detailed analyses are required to determine the on-airport and regional implications of the development intentions outlined by the airports in the study group. However, given that most of the commercial and industrial land zoned at these airports is yet to be fully developed, the successes of their zoning strategies may only be evident as more actual development manifests.

## 6 Future work

Further investigation will audit the activities within airport terminals (concessions), in addition to detailed identification of the specific kinds of retail, commercial and industrial activity taking place on airport land. This work will take the form of reviewing the range of uses on airport land, as a means to better highlight the intended customers and consumers of goods and services. This research has the potential to expose relationships that may exist between terminal activities, land use activities and different types of airports. This range of uses will then be further classified into sub-zoning categories, ie Industrial – light industrial, heavy industrial, in addition to determining if the uses may considered to be aeronautical or non-aeronautical development. Future work will also investigate international examples of on-airport land use in order to undertake comparative analyses with the Australia context.

In addition it will also be important to analyse and classifying the land use zoning categories of the region, to better highlight the urban contexts of particular airports. By reviewing these classifications collectively both on-airport and regionally, the issues which may be considered to be at the core of the airport and regional planning agendas, such as the impacts and opportunities between different zoning categories, are able to be more clearly articulated. Through future detailed analyses and sub-zoning categorisation a clearer picture of how airport and regional planners may lever the potential of a particular airport type with suitable and sustainable landside and regional developments will be recognised.

## Acknowledgements

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