

**THE IMPACT OF AIRCRAFT NOISE AND COMPLAINTS ON BRISBANE RESIDENTIAL  
PROPERTY PERFORMANCE**

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**STRUCTURED ABSTRACT**

**Problem/Purpose** – Any increase in airport operations or development, combined with increased flight movements, tends to be an issue in major cities and towns. Whenever such proposals are first advertised there is usually a very strong public backlash based on the premise that they believe that the value of their residential properties will decrease and it will become more difficult to sell their properties.

**Design/methodology/approach** –The paper provides a full analysis of residential property sales transactions that have occurred over the period 1988 to 2013, across a range of Brisbane suburbs subject to varying levels of aircraft noise complaints. These sales have been analysed on the basis of suburb location under existing flight paths, as well as suburbs that will be subject to flight paths when the new Brisbane Airport parallel runway commences operations and suburbs that have no exposure to aircraft noise.

**Findings** – Over the past 27 years the capital return for Residential property across Brisbane has been determined by a range of factors, with socio-economic status of the suburb having the greatest impact on the investment performance. When suburbs with significant exposure to aircraft noise and aircraft noise complaints are isolated there is minimal if any decrease in property capital returns or median house prices compared to non-affected suburbs. Even those suburbs closest to the airport and directly under existing flight paths had similar growth in residential house prices compared to similar socio-economic locations indicating that factors such as location to the Brisbane CBD, schools, services and recreation facilities have a greater impact on house values than aircraft noise.

**Research limitations/implications** – This study only looks at residential property markets on a suburb basis and this includes streets that are directly under flight paths and those streets that are adjoining and not impacted to the same extent. Further analysis has been undertaken to address this limitation and will be presented in future research.

**Originality/value** –This is the first longitudinal study carried out on the impact of aircraft noise across an extensive study area in Australia. The analysis covers a range of Brisbane suburbs from low middle socioeconomic status through to High socio-economic residential locations.

**Keywords:** Rural property, capital returns, income and total returns, farm investment

Theme: Investment and Finance

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## 1. INTRODUCTION

The impact of aircraft noise on surrounding property values has been the subject of much media attention and many international academic studies. Academic and media reports state that the impact of aircraft noise may reduce property value by up to 20%. Although many authors recognize that aircraft noise is one factor that is balanced against others in the decision to purchase a home, it is also common for locations with a high level of aircraft noise to be close to the CBD, transport, schools or other social infrastructure, which can add value to residential property.

A review of literature showed that the majority of academic studies in this area have been undertaken in the USA or The Netherlands with significantly less attention in the UK and Australia. Predominantly these studies have been based on econometric modeling using hedonic price models, with the pre 1980 studies showing price reductions for aircraft noise impact from 2 to 24% (Mieszkowski and Saper, 1978; Gautrin, 1975). Nelson (1980) also lists the various authors and their studies to arrive at the above statistics.

Later studies from 1990 to 2000 also were HPM based and generally recorded reductions in prices for houses impacted by aircraft noise. Most commonly these later studies also found that there was some negative impact on residential properties. However, there were also studies that should the close proximity to an airport can actually result in higher residential house prices, but aircraft noise is not the only factor that determines residential property prices. Also the distance from the airport resulted in less impact, with for commercial and industrial property the impact was not significant compared to residential property (Pennington et al, 1990; Frankel, 1991; Collins and Evans, 1994; Levesque, 1994; Feitelson, 1996; Schipper, 1996; Kaufman and Espey, 1997; Johnson and Button, 1997; Schipper et al, 1998; Tomkins et al, 1998; Little V Dept Natural Resource QLD, 1999).

Since 2000 the aircraft noise studies have also been Hedonic Price Model basis and have shown reductions in the most affected properties of 11 to 16%, with a lower impact on residential property rents (Morrell & Lu, 2000; Bell, 2001; Burns, 2001; WAPC, 2004; Theebe, 2004; McMillen, 2004; Praag & Baarsma, 2005; Baranzini & Ramirez, 2005; Lazie & Golaszewski, 2006).

Overall these academic studies showed the impact of aircraft noise on residential property was only evident beyond 60dB and had no impact up to this level.

A deficiency of the majority of these studies was the limited time period over which they were undertaken of 12 or 24 months, limited transaction data and the difficulty in isolating aircraft noise as the single influencing factor in resulting property values.

This study considers the issue of the impact of aircraft noise on the value of residential property in Brisbane, and is more comprehensive and longitudinally significant than previous international studies. The study is specific to Brisbane and covers one of the most extensive time periods for a study of this type, from the opening of the current Brisbane airport in 1988 through to December 2013. The data for this project comprised all residential house sales for 36 suburbs

A total of 36 Brisbane suburbs were identified for the study based on the number of noise complaints to Air Services Australia and reported on their website. The suburbs were grouped according to high level of noise complaints (HNC), moderate levels of noise complaints (MNC) and suburbs that have not recorded any noise complaints or very limited occasional noise complaints over the past two years (NNC). The high noise complaint suburbs were located on the southern flight paths and within 10 kms from the existing main runway at Brisbane airport. The moderate MNC

suburbs covered a range of locations to the south, west, north and east of the Brisbane airport but all inner ring or middle ring Brisbane suburbs and also within a 5-10km radius from the Brisbane airport. The NNC suburbs were also geographically diverse including inner ring, middle and outer middle ring suburbs of Brisbane.

**Table.1: Brisbane Suburb Comparison**

High Noise Complaints	Low Noise complaints	No/minimal noise complaints
<b>Morningside</b>	Gordon Park	Annerley
<b>Coorparoo</b>	Northgate	Mitchelton
<b>Camp hill</b>	Bulimba	New Farm
<b>Cannon Hill</b>	Mount Gravatt East	Mansfield
<b>Tarragindi</b>	Balmoral	Virginia
<b>Seven Hills</b>	Clayfield	Chelmer
<b>Tingalpa</b>	Ashgrove	Sherwood
<b>Norman Park</b>	Chapel Hill	Jindalee
<b>Holland Park West</b>	Wynnum	Forest Lake
<b>The Gap</b>	Fairfield	Kenmore
<b>Murarrie</b>	Hawthorne	Graceville
<b>Belmont</b>	Ascot	Hamilton

This research study is based on the analysis of residential property sale transactions for the 26 years from 1988 to 2013 inclusive across a range of Brisbane suburbs with varying exposure to aircraft movements and noise. Table 1 provides the classification and location of the suburbs analysed in the study.

Suburbs were classified initially based on the number of aircraft noise complaints (contacts and clients) recorded by Air Services Australia over the past 5 years. These suburbs were identified as High Noise Complaints (HNC); Moderate Noise Complaints (MNC) and Minimal/No Noise Complaints (NNC) based on the data and mapping provided in the Brisbane Airport Corporation Current and Future Flight Path and Noise Information Booklet. All suburbs analysed in the study were inner ring to outer middle ring suburbs of Brisbane and were located within a 14km radius from the Brisbane Airport existing runway (southern end). In total over 113,000 sale transactions were analysed to compare the residential property investment performance of these varying aircraft noise affected suburbs, based on median and average house prices, average annual capital returns, return volatility and the correlation between annual median and average house prices.

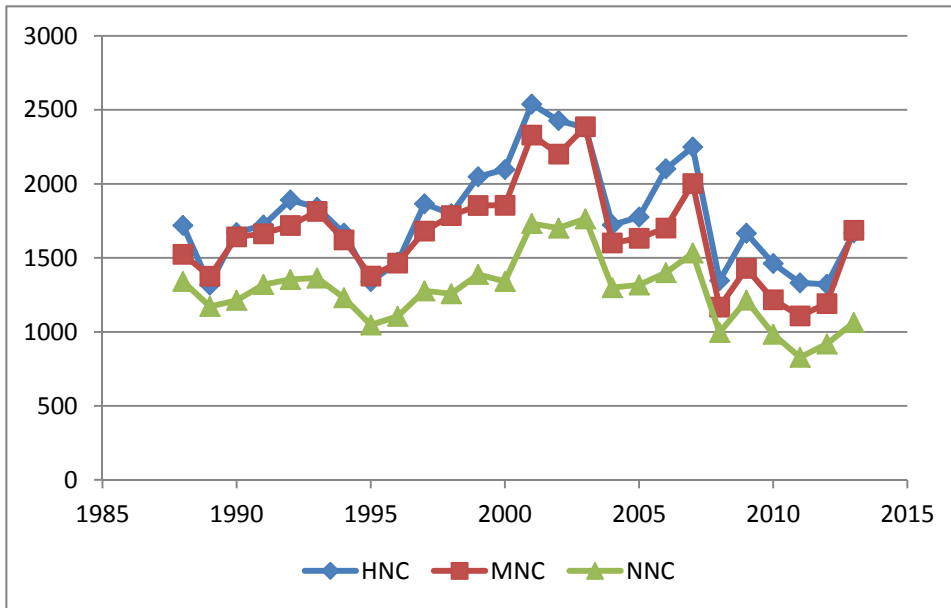
## 2. RESULTS

### 2.1 Noise Complaint Suburbs

Figure.1 shows the volume of house sale transactions for the HNC, MNC and NNC suburbs for the period 1988 to 2013.

The numbers of sales for the HNC and MNC locations were higher than the NNC suburbs, with the HNC suburbs having a high of 2,539 sales in 2001 and a low of 1,168 sales in 2008; however, this was expected as the majority of suburbs in the HNC classification locations are in the middle socio-economic locations of Brisbane, which traditionally have a higher rate of sales compared to the higher socio-economic suburbs of Brisbane.

**Figure 1 Sales Volume Comparison: 1988-2013**



The interesting findings from these suburb comparisons is the fact that despite the variation in the number of sales per annum, the actual trend in sales has been consistent across all the noise complaint areas, especially for the HNC and MNC suburbs, with all classifications showing increasing and decreasing rates of sales over each year of the 26 year period. This is also confirmed in Table 3-1, which shows the correlation between the number of annual sales across the three suburb classifications.

**Table 2: Correlation Analysis: Sales Volume: Noise Complaint Comparison: 1988-2013**

	<i>HNC</i>	<i>MNC</i>	<i>NNC</i>
HNC	1.00		
MNC	*0.90	1.00	
NNC	*0.89	*0.91	1.00

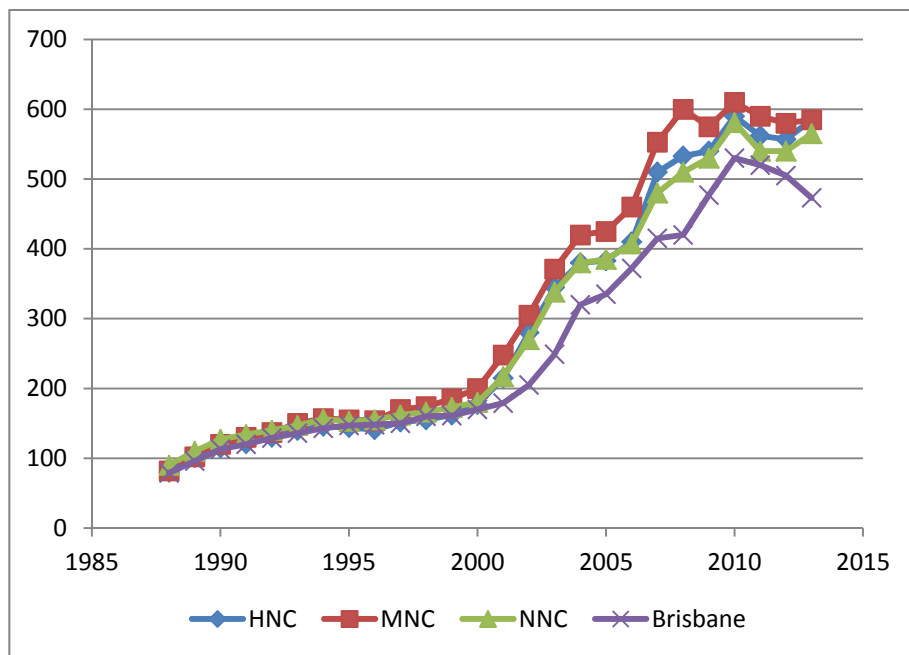
\*Significant at the 5% Level

This table shows the correlation co- efficients are very highly positively correlated at  $r = 0.90$  (HNC, MNC),  $0.89$ (HNC,NNC) and  $0.91$  (MNC,NNC). The very high significance of these correlations are evidenced by the fact that a significant co-efficient at the 5% level is  $r = +/-0.37$ . These results show that the location of a suburb under a flight path has no impact on the volume of residential house sales at any point in time compared to suburbs that have some or no exposure to flight paths and aircraft noise. Ownership of a property under a flight path and subject to aircraft noise in Brisbane does not affect the ability to sell that house compared to moderate or non-affected houses.

Figures 2 and 3 show the annual trend in median and average house prices for the 36 suburbs from 1988 to 2013.

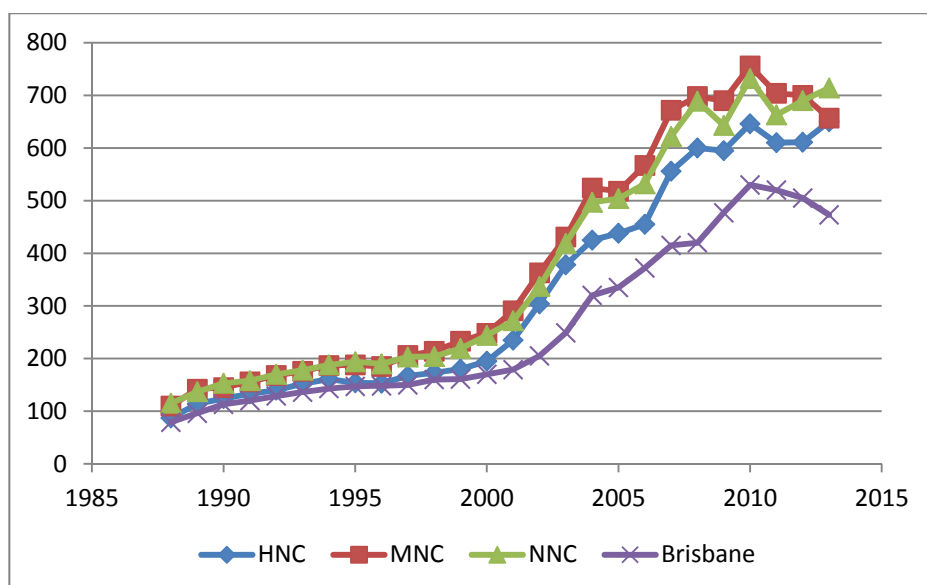
From the period 1988 to 2000, there was limited movement in median house prices across all the 36 suburbs in Brisbane, with the HNC, MNC, NNC and Brisbane LGA median house prices increasing at a similar rate, with all classifications showing 100% increases in median prices over this 13 year period

**Figure 2: Median House Price: Noise Complaint Comparison: 1988-2013**



However, from the year 2000, there has been a significant difference in the median price of the suburbs in the HNC, MNC and NNC suburbs compared to the Brisbane median house price. This is due to the fact that over the period 2000 to 2013 much of the growth in housing supply in Brisbane has been in the outer middle and outer Brisbane suburbs, with limited increases in housing supply in the suburbs in the inner and inner middle ring suburbs.

**Figure 3: Average House Price: Noise Complaint Comparison: 1988-2013**



The other major finding from this analysis of the median house prices in the suburbs that are subject to high to moderate aircraft noise is that the trend in house prices has been very similar and the higher median house prices in the MNC suburbs is based more on the fact that half the suburbs in this noise classification are high socio-economic suburbs as described above.

This figure also shows that the trend in price movement from year to year has been virtually identical for the suburbs in the HNC classification compared to the suburbs in the NNC suburbs. This indicates that residential property prices in HNC suburbs of Brisbane are not adversely affected by aircraft noise compared to locations that have less or minimal aircraft noise issues and in a number of years the more convenient location of these suburbs to the Brisbane CBD and services has resulted in the median price being higher than non-affected locations.

Table 3 also supports the strong correlation between house price movements across the suburbs in the study. The annual change in median house prices between houses in the HNC to houses in MNC and NNC suburbs are highly positively correlated with correlation coefficients of  $r = 0.95$  (HNC,MNC) and  $r = 0.96$  (HNC, NNC). These extremely high correlation coefficients state that over the 26 year time period the movement in house prices across the suburbs in the high, moderate and no aircraft noise complaint suburbs have been identical, regardless if the suburb is located close to the airport or under the various flight paths for the current Brisbane airport runway.

**Table 3: Correlation: Suburb Comparison: Median Price: 1988-2013**

	<i>HNC</i>	<i>MNC</i>	<i>NNC</i>	<i>Brisbane</i>
HNC	1.00			
MNC	*0.95	1.00		
NNC	*0.96	*0.93	1.00	
Brisbane	*0.62	*0.62	*0.69	1.00

\*Significant at the 5% level

Again, Figure 3 shows that over the full 26 years of this study the trend in annual changes in average house prices have been very similar, however the average prices for the HNC suburbs has been less on a yearly basis compared to the MNC and NNC suburbs, but all the research study suburbs had an average annual house price higher than the Brisbane median house price. The actual trend in house price change per year has been very similar for suburbs in the HNC, MNC and NNC suburbs. All these suburbs experienced their highest average price in 2010, when prices dropped in 2011 and 2012, before an increase in 2013. Since 2010, the median price for houses in Brisbane has been declining. Table 4 also shows that the correlation between the average annual change in house prices between the HNC, MNC and NNC suburbs in Brisbane have also been extremely highly positively correlated HNC to MNC ( $r=0.89$ ), HNC to NNC ( $r= 0.87$ ), with these suburbs also being significantly positively correlated with the Brisbane median house price (HNC and Brisbane  $r = 0.59$ )

**Table 4: Correlation: Suburb Comparison, Average Price: 1988-2013**

	<i>HNC</i>	<i>MNC</i>	<i>NNC</i>	<i>Brisbane</i>
HNC	1.00			
MNC	*0.89	1.00		
NNC	*0.87	*0.85	1.00	
Brisbane	*0.59	*0.71	*0.64	1.00

\*Significant at the 5% level

The investment performance of the HNC, MNC and NNC suburbs and the Brisbane Median house price are shown in Table 5. This Table shows that over the 26 year period the average annual capital return based on median house prices for HNC suburbs under the southern flight path has been 8.66%. This capital return has been greater than the average annual capital return for MNC suburbs

(8.52%) and NNC suburbs (7.93%). All the HNC,MNC and NNC suburbs returned a higher average annual capital return compared to the Brisbane median capital return of 7.72%

**Table 5: Capital Return and Investment Performance: Median Price 1988-2013**

Location	Average Annual Capital Return (%)	Average Annual Volatility (%)	Risk return Ratio
High Noise	8.66	9.49	1.09
Moderate Noise	8.52	8.87	1.04
No/Low Noise	7.93	8.47	1.07
Brisbane LGA	7.72	8.35	1.08

The HNC suburbs also had the highest volatility at 9.49%, with the NNC suburbs having a very similar volatility to the Brisbane median volatility and the MNC suburb volatility. On a risk return basis based on median price change over the study period, each of the noise affected and non-noise affected suburbs have a very similar risk return ratio ranging from 1.04 (MNC), 1.07 (NNC), 1.08 (Brisbane) and 1.09 for HNC suburbs. This again shows that the investment performance and risk for houses in high aircraft noise suburbs is no different to the investment performance of the moderate and no noise suburbs with similar location characteristics.

Based on the average annual price changes for the 26 year period in Brisbane, the HNC suburbs have also shown the highest investment returns with an average an capital return of 8.77%, well above the average annual return for MNC suburbs (7.8%) and NNC suburbs (7.9%) (Refer To Table 6).

**Table 6: Capital Return and Investment Performance: Average Price 1988-2013**

Location	Average Annual Capital Return (%)	Average Annual Volatility (%)	Risk return Ratio
High Noise	8.77	9.71	1.11
Moderate Noise	7.80	9.43	1.21
No/Low Noise	7.90	8.52	1.08
Brisbane LGA (median)	7.72	8.35	1.08

This table also shows that on an average price basis the volatility for MNC suburbs has been closer to the volatility of the HNC suburbs, predominately due to the higher volatility of the higher value properties in the higher socio-economic suburbs. Due to these similar levels of volatility in between the HNC and MNC suburbs, the risk/return ratio based on average prices is higher for the MNC suburbs (1.11 to 1.21).

### **Suburb Comparison: Houses (High Noise Complaint Suburbs v Middle Socio Economic Suburbs)**

The suburb comparisons above are based on levels of noise complaints with the HNC suburbs comprising the middle socio-economic suburbs on the southern flight path ranging from 2 to 7 kms from the current Brisbane airport runway. The MNC and LNC suburbs comprised a mixture of upper low, middle and high socio-economic suburbs. To compare the price difference between noise affected and moderate to non-noise affected suburbs, the 12 HNC suburbs were matched with 12 middle socio-economic suburbs in the MNC and LNC categories. This has allowed a comparison of median and average house prices for affected and non-affected suburbs to be assessed to determine average price differences for the period 1990 to

2013. If the variation in price is similar in each case than the main determinant of value in these matched socio-economic suburbs would be locational based rather than actual exposure to aircraft noise.

**Figure 4 Houses Median Price: High Noise Complaint Suburbs v Middle Socio Economic Suburbs:1988-2013**

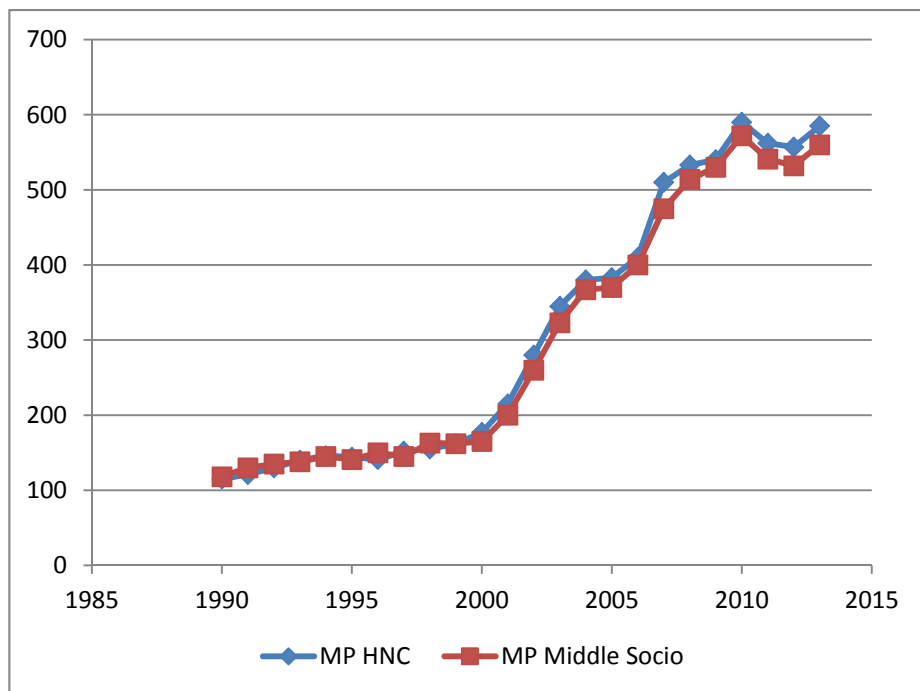


Figure 4 shows the trend in median prices movement for the period 1988 to 2013 based on the comparison of middle socio-economic suburbs in the HNC suburbs to the middle socio-economic suburbs in the MNC and NNC locations. This figure shows that from the period 1988 to 2000, the annual trend in the movement of median house prices for the HNC suburbs was virtually the same for middle socio economic suburbs in inner and middle ring locations of Brisbane, as well as the median price for houses in Brisbane. From 2000 to 2010 the median house price for the HNC and middle socio-economic suburbs have been higher but followed a similar trend to the Brisbane median house price. While the median house price in Brisbane showed a decline from 2010, this was not the case for the HNC suburbs from 2012 to 2013. This figure also shows that the change in annual median prices for HNC suburbs has been very similar to the middle socio-economic suburbs in the MNC and NNC locations and over a number of years has actually been higher.

**Table 7: Correlation Analysis: Median and Average Prices 1988-2013**

	<i>MP HNC</i>	<i>MP Middle Socio</i>	<i>AP HNC</i>	<i>AP Middle Socio</i>	<i>Brisbane</i>
MP HNC	1.00				
MP Middle Socio	*0.86	1.00			
AP HNC	*0.97	*0.84	1.00		
AP Middle Socio	*0.75	*0.89	*0.78	1.00	
Brisbane	*0.62	*0.67	*0.59	*0.66	1.00

\*Significant at the 5% level

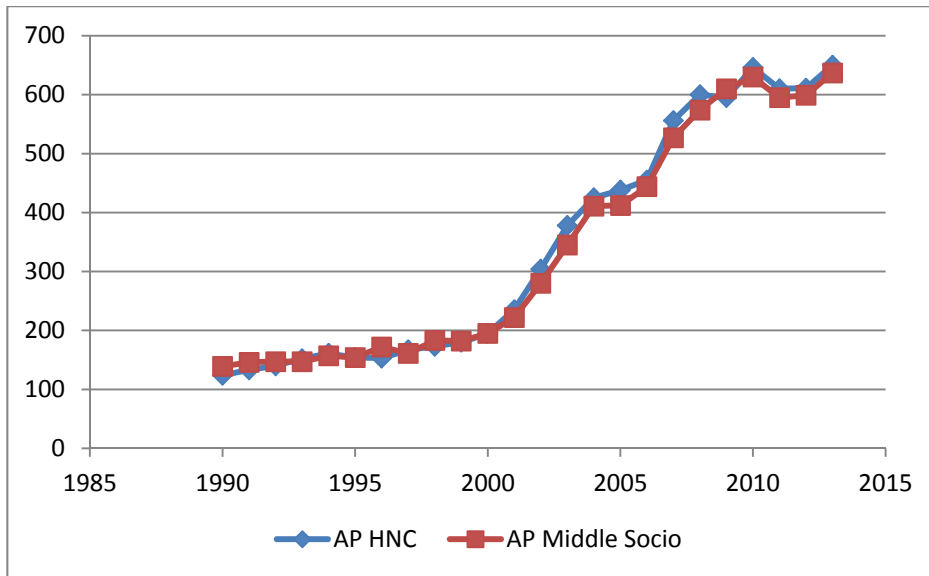
Again, the very highly positive significant correlation between the movement in house prices in the HNC suburbs to middle socio-economic suburbs in Brisbane is confirmed in Table 7, with the correlation coefficient for HNC v Middle socio-economic  $r = 0.86$  (significant coefficient at 5% level  $r = 0.37$ ).



The correlation between the HNC and middle socio-economic suburbs is stronger than the correlation with the Brisbane median house price.

Figure 5 represents the trend in the average house price HNC v middle socio-economic suburbs, with the same trend being reflected in both these housing sectors and again well above the Brisbane median house price. In the case of the average house price the correlation between HNC and middle socio-economic suburbs is again very highly positively correlated at  $r= 0.78$ , with the average price in the middle socio-economic suburbs being higher from the period 1988 to 2000, but after 2000, the average price for houses in the HNC suburbs was higher than the middle socio-economic suburbs

**Figure 5 Houses Average Price: High Noise Complaint Suburbs v Middle Socio Economic Suburbs: 1988-2013**



Tables 8 and 9 again show that over the full 26 year period of this study both the median and average house price in the southern flight path suburbs subject to the highest number of aircraft noise complaints and under the main southern flight path has shown a higher average annual capital return compared to middle socio-economic suburbs and the overall Brisbane housing market, with very similar volatility and risk/return ratios.

**Table 8: Capital Return and Investment Performance: Median Price 1988-2013: HNC v Middle Socio-economic Suburbs**

Location	Average Annual Capital Return (%)	Average Annual Volatility (%)	Risk return Ratio
High Noise Suburbs	8.66	9.49	1.09
Middle socio Economic Suburbs	8.43	9.54	1.13
Brisbane LGA	7.72	8.35	1.08

With this very similar trend in the movement in annual median and average house prices between the HNC suburbs and middle socio-economic suburbs in Brisbane, the percentage difference in the median and average house price for each of the 26 years are shown in Table 10. This Table also shows the average annual median and average house price over the period 1988 to 2013. From the median house price results, there have been 4 years during the period 1988-1992 where the median price for middle socio-economic suburb houses were higher than houses in the HNC suburbs, with the HNC suburbs recording a higher median price for each of the years from 1993 to 2013.

On an average annual basis the median price for houses in the HNS suburbs were actually 2.11% higher than the median price for houses in the middle socio-economic suburbs.

**Table 9: Capital Return and Investment Performance: Average Price 1988-2013: HNC v Middle Socio-economic Suburbs**

Location	Average Annual Capital Return (%)	Average Annual Volatility (%)	Risk return Ratio
High Noise Suburbs	8.72	9.68	1.11
Middle socio Economic Suburbs	7.66	8.87	1.16
Brisbane LGA	7.72	8.35	1.08

However, on an average price basis there have been 9 separate years where the average price for houses in the middle socio-economic suburbs have been higher than the HNC suburbs (17 years where the reverse has been the case). Again this difference can be attributed to the actual location of the HNC complaint suburbs all being located in South Brisbane and the middle socio-economic suburbs in the study being predominately inner city and northern suburbs. Until the early 2000s, there had been a price premium for houses located in Brisbane's northern suburbs compared to the south Brisbane locations and this is confirmed in the results shown in Table 10.

**Table 10: Annual % Variation between HNC Suburbs and Middle Socio-economic Suburbs: Median Price and Average Price**

Year	Median Price Comparison (%)	Year	Average Price Comparison (%)
1988	-1.23	1988	-19.27
1989	3.06	1989	-12.88
1990	-2.54	1990	-10.79
1991	-6.92	1991	-8.90
1992	-3.70	1992	-4.76
1993	1.45	1993	3.40
1994	0.69	1994	2.55
1995	2.13	1995	0.00
1996	-6.00	1996	-11.05
1997	4.83	1997	3.73
1998	-4.91	1998	-5.46
1999	0.00	1999	-1.10
2000	7.27	2000	0.00
2001	7.50	2001	5.86
2002	7.69	2002	8.57
2003	6.81	2003	9.57
2004	3.54	2004	3.41
2005	3.51	2005	6.31
2006	2.50	2006	2.48
2007	7.37	2007	5.50
2008	3.70	2008	4.53
2009	1.89	2009	-2.46
2010	3.15	2010	2.54
2011	3.88	2011	2.52
2012	4.70	2012	2.00
2013	4.46	2013	2.04
<b>Average Annual Difference</b>	<b>+2.11</b>	<b>Average Annual Difference</b>	<b>-0.45</b>

Over the past 26 years the middle socio-economic average annual price differential compared to the HNC suburbs has been 0.45% higher. However, from 2000 to 2013 the price difference has been greater in the HNC suburbs (3.77% per year).

### **3. Conclusions**

The first major study on the impact of aircraft noise on Brisbane residential property has shown that locations close to the airport or under a flight path, has minimal or no impact on residential property prices and residential property investment performance.

Over the study period 1988 to 2013, the research found the location of a property under a flight path will have minimal if any impact on the price, sales volume, investment performance and capital growth of a property.

Residential property value drivers, such as proximity to transport, the Brisbane CBD, schools, recreation facilities and other services, appear to far outweigh any negative impact experienced as a consequence of being under a flight path or from aircraft noise.

### **4. References**

- 1 Baranzini, A., and Ramirez, J., Paying for quietness: the impact of noise on Geneva rents, *Urban Studies Journal*, <http://www.sagepublications.com> (accessed 15 October 2014)
- 2 Bell, R., 2001, The impact of airport noise on residential real estate, *The Appraisal Journal*, July 2001.
- 3 Brisbane Airport Corporation. 2014. Current and Future Flight Path and Noise: Information Booklet. Brisbane Airport Corporation Pty Ltd.
- 4 Burns, M., Measuring the changing effects of aircraft noise a case study of Adelaide Airport, the seventh annual Pacific Rim Real Estate Society Conference, Adelaide, Australia, 21-24 January 2001.
- 5 Collins, A. and Evans, A. 1994. Aircraft noise and residential property values: An Artificial Neural Network approach. *Journal of Transport Economics and Policy*. Vol 28, No. 2, pp 175-197.
- 6 Feitelson, E. I., Hurd, R.E. and Mudge, R.R. 1996. The impact of airport noise on willingness to pay for residences. *Transportation Research Part D*. Vol, 1, No. 1, pp 1-14, Elsevier Science Ltd.
- 7 Frankel, M. 1991. Aircraft noise and residential property values: Results of a survey study. *The Appraisal Journal*. Vol 59, No. 1 pp 96-110.
- 8 Gautrin, J-F. 1975. An evaluation of the impact of aircraft noise on property values with a simple model of urban land rent. *Land Economics*. Vol 51, No. 1, pp 80-86.
- 9 Johnson, K and Button. K. 1997. Benefit transfers: Are they a satisfactory input to benefit cost analysis? An airport noise nuisance case study. *Transportation Research Part D*. Vol, 2, No. 4, pp 223-231, Elsevier Science Ltd.
- 10 Kaufman, H. and Espey, M. 1997. No plane, no gain: Airport noise and residential property values in the Reno-Sparks area. Western Agricultural Economics Association. Annual Meeting. Nevada, July 13-16, 1997.
- 11 Lazic, A. and Golaszewski, R., 2006, A technical note on aircraft noise and its cost to society, GRA Incorporated, Economic Council to the Transportation industry, Home office, Jenkintown, PA.
- 12 Levesque, T.J. 1994. Modelling the effects of airport noise on residential housing markets: A case study of Winnipeg International airport. *Journal of Transport Economics and Policy*. Vol 28, No. 2, pp 199-210.

- 13 Mieszkowski, p. and Saper, A.M. 1978. An estimate of the effects of airport noise on property values. *Journal of Urban Economics*. Vol 5, pp 425-440.
- 14 Morrell, P., and Lu, C., 2000, Aircraft noise social cost and charge mechanisms – a case study of Amsterdam Airport Schiphol, *Transportation Research, Part D*, 305-320.
- 15 Nelson, J.T. 1980. Airports and property values: A survey of recent evidence. *Journal of Transport Economics and Policy*. Vol 14, No. 1, pp 37-52.
- 16 Pennington, G., Topham, N and Ward, R. 1990. Aircraft noise and residential property values adjacent to Manchester international airport. *Journal of Transport Economics and Policy*. Vol 24, No. 1, pp 49-59
- 17 Schipper, Y.J.J. 1996 On the valuation of aircraft noise: A Meta-Analysis. European Regional Science Association. 36<sup>th</sup> European Congress. ETH Zurich, Switzerland, 26-30 August 1996.
- 18 Schipper, y., Nijkamp, P and Rietveld, P. 1998. Why do aircraft noise values differ? A meta-analysis. *Journal of Air transport Management*. Vol 4, pp 117-124.
- 19 Theebe, M., Planes, trains and automobiles: the impact of traffic noise on house prices, 2004, *Journal of Real Estate Finance and Economics*, 28:2/3, 209-234.
- 20 Tomkins, J., Topham, N., Twomey, J and Ward R. 1998. Noise versus access: The impact of an airport in an urban property market. *Urban Studies*. 1998 35:243
- 21 Van Praag, B., and Baarsma, B., 2005, Using happiness surveys to value intangibles: the case of airport noise, *The Economic Journal*, 115, January, 224-246.
- 22 WACA, 2004, Aircraft noise insulation for residential development in the vicinity of Perth Airport, Final Report, February 2004.

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