MAJOR INFRASTRUCTURE INNOVATION AND THE PUBLIC RESPONSE: AIRCRAFT NOISE AND RESIDENTIAL PROPERTY MARKETS: BRISBANE AND GOLD COAST AIRPORTS

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ABSTRACT

Innovation and the expansion of major infrastructure are not always welcomed by the public. This is especially the case if this innovation and infrastructure is perceived to have a negative impact on the community that has a direct or indirect interest in the new development or infrastructure. All new innovation and infrastructure projects in Australia are most often challenged by individuals and interest groups for the potential impact that the new development may have on the environment, health of the community and most often the value of their property.

Over the past ten years in Australia there has been an increasing number of domestic and international air travellers and the subsequent increase in aircraft movements. This substantial increase in the number of flights and passengers has resulted in a number of Australian major airports developing additional runways and flight paths to meet these increased traveller and business demands. Two examples of this trend is the development of a second parallel runway at the Brisbane Airport and a new Instrument Landing System flight path at the Gold Coast Airport. Both these developments have attracted considerable public backlash and complaints to both the airport management and federal government departments, with the majority of these complaints based on the potential loss in value for houses that will be under the new flight paths or subject to additional or new aircraft noise.

This paper reviews the residential property markets across a range of suburbs in Brisbane, Gold Coast and Northern New South Wales that are under existing flight paths, adjoining existing flight paths or not affected by flight paths to determine the long term impact on residential property investment performance. This is the first major longitudinal study carried out in Australia specifically addressing the impact of aircraft noise on residential property investment performance based on prices and rents. The study covers over 50 residential suburbs over the period 1988 to 2014.

Keywords: *Airports, Infrastructure, Aircraft Noise, Property Values, Residential Property, Property Stigma*

1.0 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 values 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 (Central Business District), transport, schools or other social infrastructure, factors which can add value to residential property depending on the individual value drivers of the purchasers.

Many studies adopting the Hedonic Price Models (HPM) have shown a reduction in price for houses located under plight paths or subject to aircraft noise; however, these studies have not considered if this possible lower initial price also results in lower capital growth in the longer term. This study has been undertaken to determine if the actual average annual investment performance (capital returns) of aircraft noise affected property is similar to the investment performance of houses in non or less affected locations over extended time periods or if any initial decrease in property prices when a residential property becomes subject to aircraft noise continues to be reflected in the ongoing capital return and volatility over time.

2.0 LITERATURE REVIEW

Literature on the impact of aircraft noise on communities can be categorised into the following areas:

- Impact on physical and mental health issues
- Stress levels
- Sleep depravation
- Cognitive learning impacts on children
- Property impact
- Environmental impacts

The literature in relation to the negative impact of aircraft and transport noise on health, stress, the environment and learning is extensive (for example Brunelle-Yeung et al, 2014; Stansfeld et al, 2011 and 2005; Mahashabde et al, 2011; Eriksson et al, 2007; Upham et al, 2003; Hygge et al, 2002; Franssen et al, 2002). Additional studies have also identified the type and reason for aircraft noise complaints including factors such as number of aircraft movements, type of aircraft and deviation from established flight paths (Hume et al. 2003).

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 etal,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) NITRL.

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,2014; 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.

All these studies have focussed on the potential price difference between residential properties affected of not affected by aircraft noise or airport operations. None of these studies has actually looked at the actual investment performance of aircraft noise affected property over an extended time period. 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 performance in two South east Queensland locations; Brisbane and the Gold Coast 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.

3.0 BRISBANE STUDY LOCATIONS

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
Morningside	Gordon Park	Annerley
Coorparoo	Northgate	Mitchelton
Camp hill	Bulimba	New Farm
Cannon Hill	Mount Gravatt East	Mansfield
Tarragindi	Balmoral	Virginia
Seven Hills	Clayfield	Chelmer
Tingalpa	Ashgrove	Sherwood
Norman Park	Chapel Hill	Jindalee
Holland Park West	Wynnum	Forest Lake
The Gap	Fairfield	Kenmore
Murarrie	Hawthorne	Graceville
Belmont	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.

4.0 GOLD COAST STUDY LOCATIONS

18 suburbs were selected for the Gold Coast Airport study. Across the three aircraft noise complaint classifications the suburbs include a range of socio-economic status suburbs, with each of the classification having a mix of lower middle, higher middle and high socio-economic suburbs. Table 2 shows a breakdown of the total suburbs based on socio-economic status (median price range).

Table 2: Suburb and Study Area Location Classifications

HNC	MNC	NNC	Southern Flight path	Northern Flight Path
Banora Point	Palm Beach	Labrador	Banora Point	Tugun
Fingal head	Tweed Heads	Southport	Fingal Head	Currumbin
Tugun	Tallebudgera	Burleigh Heads	Tweed Heads	Palm Beach
Currumbin	Miami	Bundell/ Sorrento	Tweed Heads South	Burleigh Heads
Kingscliff	Elanora	Molendir	Kingscliff	Miami
Terranora	Tweed Heads South	Ashmore	Terranora	Currumbin Waters
-	-	-	Chinderah	Coolangatta

This table confirms that the three noise complaint suburb classifications cover a range of socio-economic suburbs, with no aircraft noise classification being over represented by either high or low value suburbs to distort the study results.

5.0 RESULTS

5.1 BRISBANE: 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.

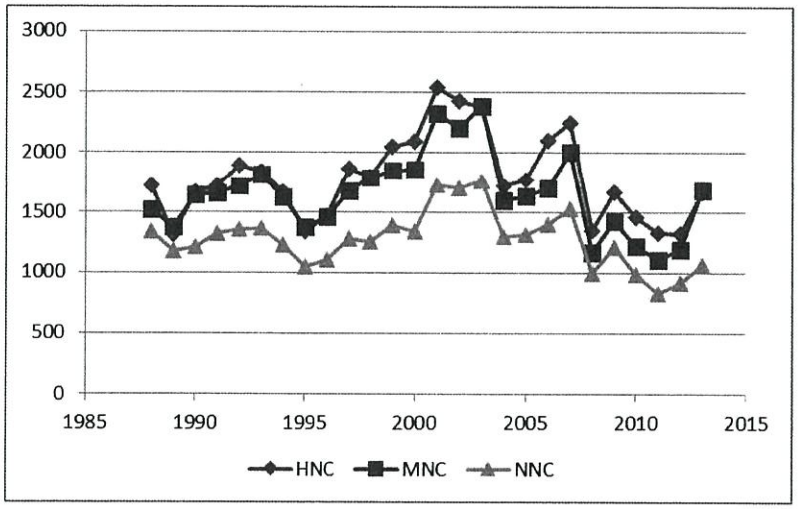

Figure 1: Sales Volume Comparison: 1988-2013

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, which shows the correlation between the numbers of annual sales across the three suburb classifications.

Table 3: Correlation Analysis: Sales Volume: Noise Complaint Comparison: 1988-2013

	HNC	*MNC*	*NNC*
HNC MNC	1.00 *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.

Figure 2 shows the annual trend in median 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.

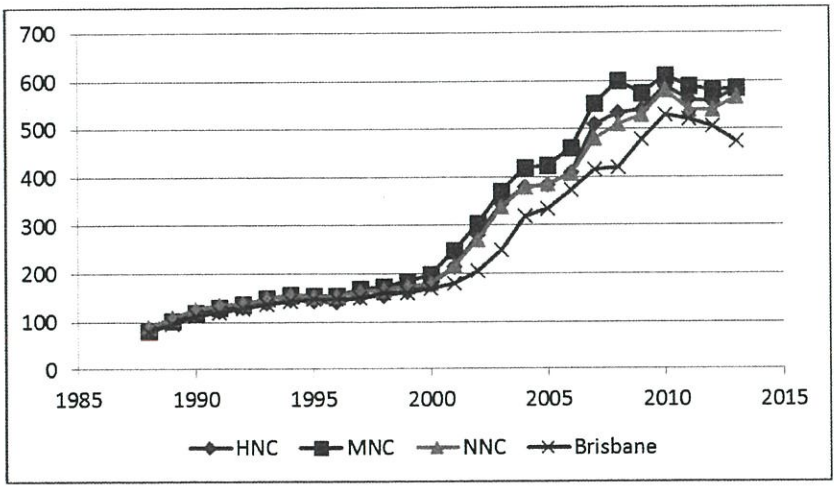

Figure 2: Median House Price: Noise Complaint Comparison: 1988-2013

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.

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 4 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,AMNC) 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 4: Correlation: Suburb Comparison: Median Price: 1988-2013

	HNC	*MNC*	*NNC*	*Brisbane*
HNC MNC	1.00 *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

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.

5.2 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.

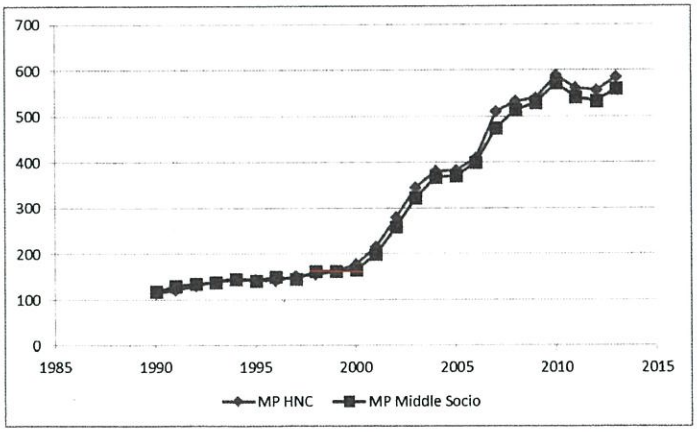

Figure 3: Houses Median Price: High Noise Complaint Suburbs v Middle Socio Economic Suburbs: 1988-2013

Figure 3 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 6: Correlation Analysis: Median and Average Prices 1988-2013

	MP HNC	*MP Middle Socio*	*Brisbane*
MP HNC	1.00		
MP Middle Socio	*0.86	1.00	
Brisbane	*0.62	*0.67	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.

Tables 7 again shows that over the full 26 year period of this study both the median 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 7: Capital Return and Investment Performance: Median Price 1988-2013: HNC v Middle Socio-economic Suburbs

Location	**Average Annual Capital Return (%)**	**AverageAnnual Volatility (%)**	**Risk return Ratio**
High Noise Suburbs	8.66	9.49	1.09
Middlesocio 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 house prices between the HNC suburbs and middle socio-economic suburbs in Brisbane, the percentage difference in the median house price for each of the 26 years are shown in Table 8. 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.

Table 8: Annual % Variation between HNC Suburbs and Middle Socio-Economic Suburbs: Median Price and Average Price

Year	Median Price Comparison (%)
1988	-1.23
1989	3.06
1990	-2.54
1991	-6.92
1992	-3.70
1993	1.45
1994	0.69
1995	2.13
1996	-6.00
1997	4.83
1998	-4.91
1999	0.00
2000	7.27
2001	7.50
2002	7.69
2003	6.81
2004	3.54
2005	3.51
2006	2.50
2007	7.37
2008	3.70
2009	1.89
2010	3.15
2011	3.88
2012	4.70
2013	4.46
Average Annual Difference	+2.11

5.3 GOLD COAST

The initial analysis compares the movement in house and unit prices based on the number of noise complaints received across a range of suburbs. Based on Air Services Australia data 18 suburbs were selected for analysis, with six suburbs classified as High Noise Complaint (HNC), six Moderate noise Complaints (MNC) and six suburbs with Minimal or No Noise Complaints (NNC). These suburbs are identified in Table 1. The majority of the HNC suburbs are located on the southern flight path and are predominately in NSW, with the MNC and NNC suburbs being located to the north and North West of the airport and are predominately Gold Coast suburbs.

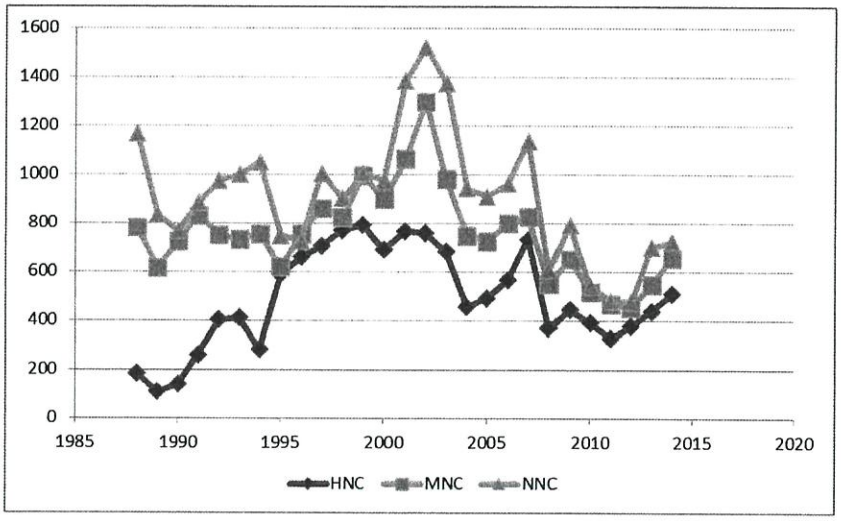

Figure 4: Noise Complaint Comparison: House Sale Transactions: 1988-2014

Figure 4 shows the movement in annual sales volume across the three suburb classifications for the period 1988 to 2014. The lower sales volume for the HNC suburbs from 1988 to 1995 reflects the increasing development of Kingscliff, with the suburbs in the MNC and NNC locations being more developed. Overall the suburbs in the HNC classification have a smaller housing stock (e.g. Fingal Head and Banora Pt) compared to suburbs in the MNC and NNC locations and this is reflected in the annual sales volume being lower This figure also shows that although the sales volume for the HNC suburbs has been lower than the MNC and NNC suburbs the actual trend in annual sales volume has been relatively similar for the period 1995 to 2014, with sales volume peaks in 2002 and 2007 and a general decline in sales volume from 2009 to 2012. Based on the trend in the number of annual sales; suburbs with high levels of aircraft noise complaints have similar percentages of house sales compared to less affected locations.

Although the actual number of house sales per year varied between the HNC suburbs and the MNC and NNC suburbs, Figure 5 shows that the trend in median house price movement across the three suburb locations has been very similar over the 27-year period.

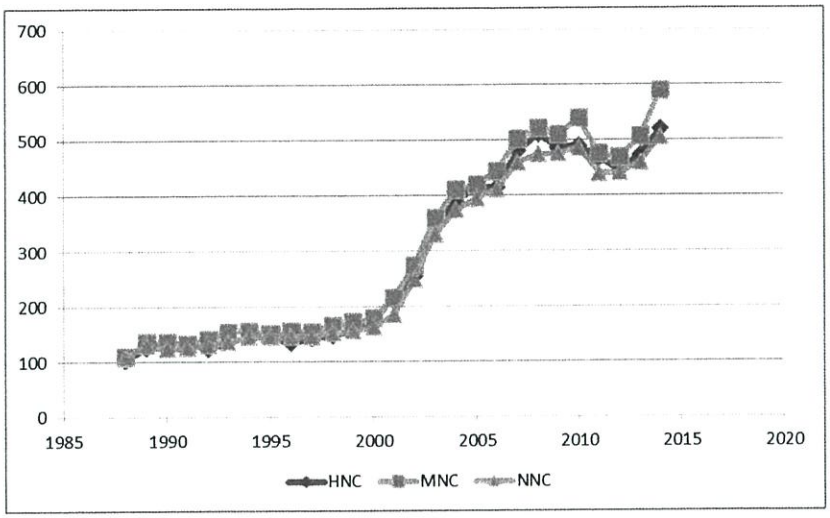

Figure 5: Median House Prices: Noise Complaint Comparison: 1988-2014

From 1988 to 2000, house price growth across all three aircraft noise classifications was very similar and relatively slow increasing from $100,000 to $110,000 in 1988 to $162,000 for NNC suburbs; $178,000 for MNC suburbs and $175,000 for HNC suburbs in 2000. From 2001 all three aircraft noise classifications increased significantly in median house prices, with the HNC and MNC suburbs outperforming the NNC suburbs. This was also a period of increasing aircraft movements, with the introduction of foreign carriers to the Gold Coast and increased domestic air traffic.

This similarity in annual movement in median house prices is also reflected in Table 9. This table shows the correlation in median house price movements for the period 1988 to 2014. Based on the 27 year time period a significant positive correlation at the 5% level in annual house price movement would be r = 0.37. Table 3 shows that based on the Gold coast residential property market prices there has been a very strong positive correlation between HNC suburbs and MNC suburbs (r = 0.84) and HNC and NNC suburbs (r = 0.84).

This confirms that over the past 27 years the actual movement in median house prices across a range of Gold Coast located suburbs, with varying exposure to aircraft noise, has been virtually identical.

Table 9: Median House Price Correlation Analysis: Noise Complaint Suburbs: 1988 - 2014

	HNC	*MNC*	*NNC*
HNC	1.00		
MNC	*0.84	1.00	
NNC	*0.84	*0.93	1.00

* Significant at the 5% level

Table 10 shows the investment performance of the various aircraft noise affected and non-affected suburbs based on median house prices. This table compares the average annual capital returns, return volatility and risk/return ratios for the period 1988 to 2014. Over the 27 year period the HNC suburbs have shown an average annual capital return of 6.88%, compared to 6.45% for the NNC suburbs and slightly lower than the MNC suburbs. On a risk return basis the risk/ return ratios were very similar across all three classifications, ranging from 1.42 to 1.53.

Table 10: Capital Return and Investment Performance: Median Price 1988-2014

Location	Average Annual Capital Return (%)	Average Annual Volatility (%)	Risk return Ratio
High Noise	6.88	10.29	1.50
Moderate Noise	7.12	10.11	1.42
No/Low Noise	6.45	9.89	1.53

Based on these results, houses in the Gold Coast locations subject to aircraft noise have shown similar, and in most cases higher, average annual capital returns compared to non-noise affected properties. This indicates that residential property prices and investment performance is linked more closely to socio-economic status than aircraft noise impact across these specific Gold Coast and NSW locations. Location of residential property under Gold Coast flight paths has not had any significant effect on the ability to sell residential property as trends in sales volume are similar and there has been limited if any reduction in capital growth over extended time periods for residential houses subject to high or moderate noise complaint levels.

These results confirm that on the Gold Coast, the decision to purchase a residential property in any given location is based on a range of factors. Exposure to aircraft noise is only one factor associated with suburbs located under aircraft flight paths. These results conclude that residential property buyers on the Gold Coast and Far North Coast of New South Wales consider a range of factors such as distance to beaches, services, employment and schools in the purchase decision not just flight paths and aircraft noise. Consequently, aircraft noise affected locations achieved similar and often higher capital growth despite this exposure to aircraft noise.

The major conclusion from the analysis is that when the housing market is considered over extended time periods (greater than 12 to 24 months), houses subject to aircraft noise across the Gold Coast and Far North Coast of NSW have an equivalent, if not higher, higher average annual capital growth, with similar risk return ratios, when compared to less affected locations.

6.0 INVESTMENT PERFORMANCE, FLIGHT PATH LOCATION

The previous analysis only grouped the various suburbs based on the level of noise complaints received by Air Services Australia. The following analysis compares the residential housing investment performance for a range of Gold Coast and Far North Coast NSW locations and suburbs based on both their location under existing flight paths, as well as their socio-economic status. This analysis summary will be based on the median house price for these selected suburbs.

6.1 FLIGHT PATHS HOUSES (MEDIAN PRICES PRICES)

This house price analysis is based on a selection of suburbs that are:

- Subject to the current southern flight path
- Subject to the northern flight path
- Not subject to any existing flight paths (but would be considered to be affected by the proposed ILS flight path
- Not subject to any existing or proposed flight paths

For this summary analysis the suburbs not affected by the northern and southern flight paths have been grouped. The actual suburb locations are identified in Table 2.

6.2 SOUTHERN FLIGHT PATH NSW

The median house prices for the seven locations under the southern flight path are shown in Figure 6. All these locations are located in the Tweed heads area and include a range of socio-economic suburbs. These range from the high value locations of Fingal Head and Kingscliff to the lower value locations of Tweed heads South and Chinderah. This graph shows that although the median price for houses has been highest in Fingal Head, the relatively high price variations for Fingal Head is more a factor of the low sales volume in this location together with a very small housing stock.

Although the median house price for Kingscliff has been higher than the other locations, this variation in median house prices has been more pronounced since 2000. Despite all these locations being under the existing flight path, the variation in median house price trend over the period 1988 to 2014, has been driven more by socio-economic status than actual house location. This is evidenced by the similar trend in median house prices for Tweed Heads South, Banora Pt and Chinderah (all lower value locations) and Tweed heads and Terranora (both middle value locations)

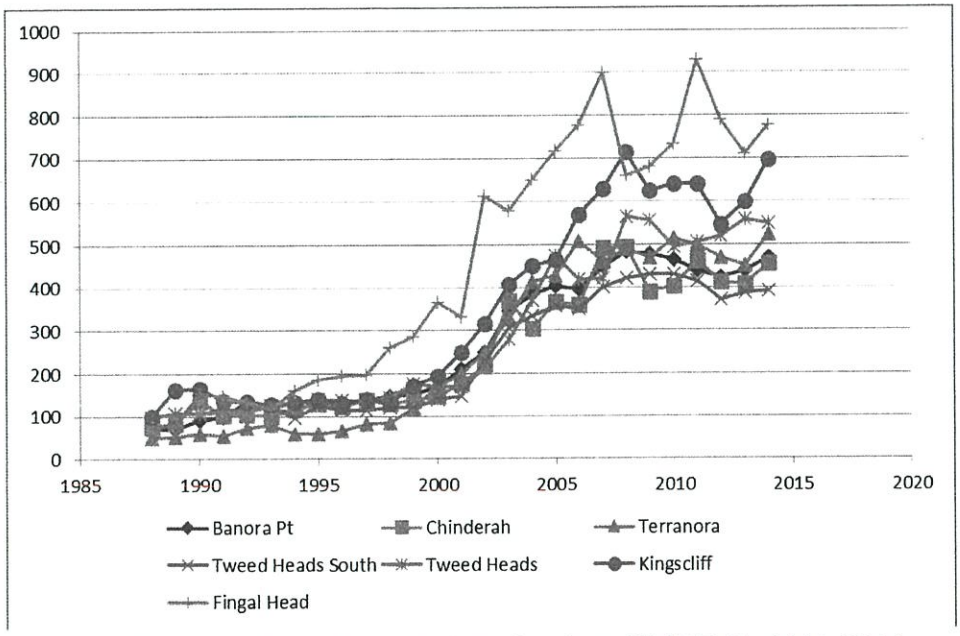

Figure 6: Median House Prices: Southern Flight Path: 1988-2014

The respective correlation coefficients for the southern flight path suburbs and towns are shown in Table 11. From this table it can be seen that there is a strong positive correlation between the movement in median house prices between Banora Pt and Chinderah (r=0.59); Banora Pt and Tweed Heads South (r=0.47) and Banora Pt and Terranora (r=0.41). All these are the lower value suburbs and locations exposed to aircraft movements and under the southern flight path. However Banora Pt only had a slight positive non-significant correlation with Tweed Heads, Fingal Head and Kingscliff.

Table 11: Median House Price Correlation Analysis: Southern Flight Path: 1988-2014

	Banora Pt	***Chinderah***	***Terranora***	***Tweed Heads South***	***Tweed Heads***	***Kingscliff***	***Fingal Head***
Banora Pt	1.00						
Chinderah	*0.59	1.00					
Terranora	*0.41	0.18	1.00				
Tweed Heads South	*0.47	0.33	0.34	1.00			
Tweed Heads	0.26	0.18	0.22	*0.44	1.00		
Kingscliff	0.26	*0.43	*0.39	*0.37	0.29	1.00	
Fingal Head	0.20	*0.43	0.05	0.31	-0.02	0.11	1.00

*Significant at the 5% Level

Other significant positive median price movement correlations tended to also have an adjoining location influence (Tweed Heads and Tweed Heads South r=0.44) and Kingscliff and Chinderah (r=0.43). Although all these suburbs and towns are subject to aircraft movements and noise, the value drivers for these locations also vary, hence the lower correlation coefficients. These factors include the permanent or holiday destination status, socio-economic status and location to major services.

Table 12: Investment Performance: Southern Flight Path: Median Prices 1988-2014

Suburb	**Average Annual Return (%)**	**Volatility (%)**	**Risk/Return ratio**
Banora Pt	8.38	13.53	1.61
Fingal Head	12.20	25.99	2.13
Tweed Heads	7.58	13.07	1.72
Tweed Heads South	6.44	15.45	2.40
Kingscliff	8.88	16.78	1.89
Terranora	10.57	16.43	1.55
Chinderah	9.09	21.78	2.40

Table 12 shows the investment performance of houses in suburbs located under or exposed to the Gold Coast Airport southern runway. Based on median house prices the average annual capital returns for these locations have ranged from 6.44% for Tweed Heads South to 12.20% for Fingal Head. Socio-economic status has not been a reliable indicator of investment performance across these locations, with both lower value locations of Chinderah and Terranora also recording high average annual capital growth of 9.09% and 10.57% respectively. Terranora median house prices not only produced a high average annual capital return but the volatility was actually lower than Kingscliff and Chinderah, both locations that recorded higher average annual capital returns. This also resulted in Terranora recording the best risk/return ratio of the seven locations.

These results show that location under the Gold Coast Airport southern flight path has not resulted in all locations having similar median house price movement across the 27 year period. Factors such as the nature of the location (socio-economic status, housing development type, size of the suburb or town, holiday destination or typical owner occupier residential) appear to have a greater influence on value than exposure to aircraft noise or aircraft movements.

6.3 NORTH FLIGHT PATH

Again the suburbs that form the basis of the North Flight path are listed in Table 2. All these suburbs are located on the Gold Coast and comprise suburbs that are predominately residential, with some beachside locations having a higher proportion of unit developments. As was the case for the southern flight path, these suburbs range from lower to high value locations based on median and average house prices.

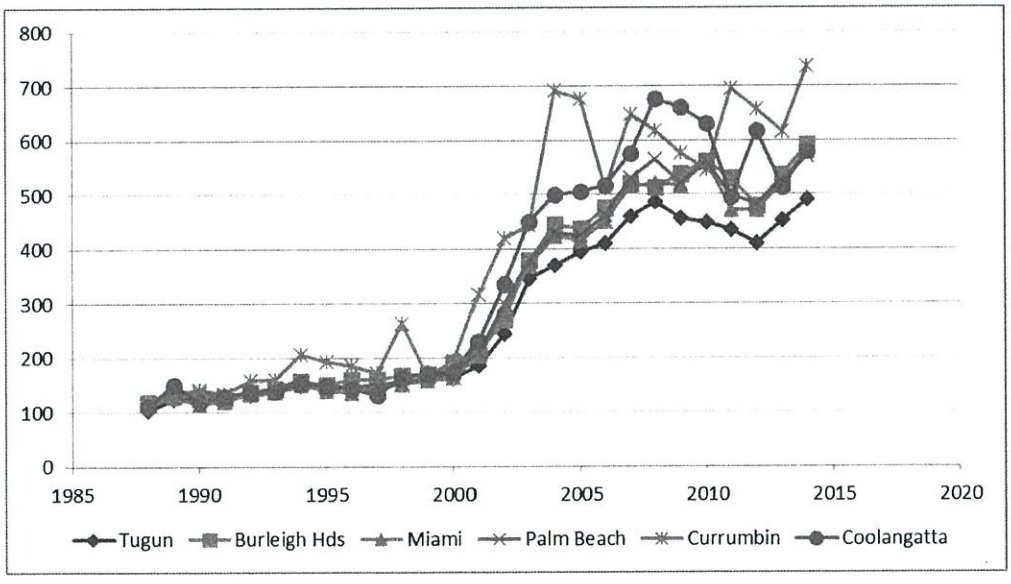

Figure 6: Median House Prices: Northern Flight Path: 1988-2014

The difference in investment and price performance of these northern flight path affected suburbs is also reflected in the socio-economic status. From 1988 to 2002, the median house price trend for the suburbs Tugun, Burleigh Heads, Miami and Palm Beach have been relatively similar, with all sectors, apart from Tugun, having significant median house price increases from 2002 to 2010. Since 2010 these suburbs have seen price decreases to 2012 and a recovery in prices from 2013. In

contrast residential house prices peaked in Tugun in 2008, with a decline in median prices until 2012, followed by a stronger recovery in prices in 2014. Currumbin and Coolangatta have shown a more volatile but higher median house price across the study period, with Currumbin median house prices peaking in 2008 and fluctuating since that date. The most volatile residential housing market in this section of the analysis has been Coolangatta, with a substantial increase in the median house price from 2004 to 2008; varying annualy with a peak in median houses prices of $735,000 in 2014 (Refer to Figure 7).

Table 13: Median House Price Correlation Analysis: Northern Flight Path: 1988-2014

	Tugun	*Burleigh Hds*	*Miami*	*Palm Beach*	*Currumbin*	*Coolangatta*
Tugun	1.00					
Burleigh Hds	*0.86	1.00				
Miami	*0.81	*0.82	1.00			
Palm Beach	*0.87	*0.81	*0.93	1.00		
Currumbin	0.29	0.33	0.34	0.34	1.00	
Coolangatta	*0.67	*0.55	*0.72	*0.72	*0.41	1.00

*Significant at the 5% Level

The correlation between the movement in median house prices for suburbs affected by aircraft noise and aircraft movement under the Gold Coast northern flight path have been extremely similar for all suburbs other than Currumbin. There have been extremely strong positive correlation coefficients for the middle value locations (Palm Beach and Miami r= 0.93; Burleigh Heads and Miami r=0.82; Burleigh Heads and Palm Beach r=0.81). Table 13 also shows that there has only been one significant correlation coefficient for the high value suburb of Currumbin (Currumbin and Coolangatta r=0.41). Although all other correlation coefficients for Currumbin were positive, they were not significant at the 5% level.

Tugun was the only lower value suburb analysed in this section of the study and is the closest suburb to the Gold Coast airport and the suburb affected most by aircraft noise. If aircraft noise was the major value driver for this suburb, it would be expected that the median house price trend would be significantly different to less affected suburbs. This analysis shows that there is an extremely high positive correlation between the movements in median house prices for Tugun compared to all middle value locations (Burleigh Hds r=0.86; Miami r=0.81; Palm Beach r=0.87). The adjoining high value suburb of Coolangatta also has a very high positive significant correlation with Tugun (r=0.67). These correlation results confirm that the lower value and middle value suburbs subject to the northern flight path have performed identically across the study period in relation to the change in median house prices from year to year.

The investment performance for Gold Coast suburbs under the northern flight path is shown in Tables 14 and 15. Table 14 reports the investment performance based on median house prices. From this table it can be seen that the average annual returns have ranged from 6.65% for Tugun to 9.95% for Currumbin. However, the average

annual return for residential houses in Tugun have actually been very similar to the average annual return for houses in Palm Beach (6.87%) and Burleigh Heads (6.86%). On a risk/return basis the two better performing suburbs were Burleigh Heads (1.55) and Tugun (1.57). The higher average annual capital returns for Currumbin and Coolangatta were also at higher levels of volatility resulting in higher risk/return ratios of 2.42 and 2.18 respectively.

Table 14: Investment Performance: Northern Flight Path: Median Prices 1988-2014

Suburb	Average Annual Return (%)	Volatility (%)	Risk/Return ratio
Tugun	6.65	10.78	1.57
Currumbin	9.95	24.08	2.42
Palm Beach	6.87	11.79	1.72
Burleigh Heads	6.86	10.60	1.55
Miami	7.02	11.86	1.69
Coolangatta	7.56	17.14	2.18

On an average house price basis, the average annual capital returns for all suburbs, excluding Burleigh Heads, increased. On an average price basis the return from residential property in Tugun was slightly higher than Burleigh Heads.

6.4 NO FLIGHT PATH

In addition to the suburbs that are directly impacted by the current airport flight paths, a further 9 Gold Coast suburbs were analyzed for the period 1988 to 2014. These suburbs are currently not affected by any existing flight paths. These suburbs were analyzed to provide a direct comparison to the investment performance of suburbs that are impacted by aircraft noise and movements. Again, these suburbs are listed in Table 1 and comprise a selection of suburbs reflecting:

- Socio-economic status
- Location close to existing affected suburbs
- Location close to or removed from the Gold Coast beaches
- Holiday destination locations and predominately owner occupied residential locations

Table 15: Investment Performance: Non Flight Path: Median Prices 1988-2014

Suburb	Average Annual Return (%)	Volatility (%)	Risk/Return ratio
Labrador	6.82	12.51	1.83
Southport	6.93	12.20	1.76
Bundell/ Sorrento	5.65	11.93	2.11
Molendir	7.50	13.36	1.78
Ashmore	6.00	9.48	1.58
Varsity Lakes	6.63	10.94	1.65
Nerang	6.53	10.86	1.66
Helensvale	7.73	12.51	1.62
Burleigh Waters	5.93	8.67	1.46

Table 15 presents the investment performance of residential houses in these suburbs based on both median and average house prices. On a median house price basis the two suburbs with the lowest average annual capital return were Bundell/Sorrento (5.65%) and Burleigh Waters (6.15%). The highest returns were from Helensvale (7.73%) and Molendir (7.50%). The other suburbs had average annual capital returns ranging from 6.00% to 6.93%.

On an average house price basis, only Varsity lakes, Nerang, Helensvale and Burleigh waters recorded an average annual capital return higher for average prices compared to median prices. All other suburbs in this section of the study recorded a lower average annual capital return based on average house prices.

7.0 CONCLUSIONS

This study has focused on the long term investment performance of residential property located in Brisbane and on the Gold Coast of Queensland. These suburbs and locations are subject to a range of aircraft noise issues including location under flight paths and in locations subject to various levels of aircraft noise complaints.

Based on long term median annual house price movements suburbs located under the main southern flight path and subject to minimum 70 Decibel aircraft noise in Brisbane have shown average annual capital growth equivalent and in some cases higher than similar housing stock in location with aircraft noise less than 70 Decibels and not located under Brisbane Airport flight paths. The study based on the same research criteria and sales transaction data type also found that the long term investment performance was similar for residential property regardless of exposure to aircraft noise.

Correlation analysis of the annual change in house prices has also shown a very high positive correlation in the annual change in both the number of sales that occur each year in the various study locations , as well as the annual movement in house prices. This suggests that in both

property boom and bust markets the increase or fall in house prices will be similar regardless of the degree of exposure to aircraft noise.
In the Brisbane and Gold Coast residential property markets; residential property value drivers, such as proximity to transport, the main CBD, schools, recreation facilities and other services, have a more significant impact on long term residential property performance than aircraft noise factors.

HPM studies have shown that the location of a residential property close to an airport or subject to aircraft noise can have a lower price compared to non-affected presidential properties in similar socio-economic locations in the same property market. This study has shown that in Brisbane and the Gold Coast that even if the house price may be lower due to aircraft noise issues, the actual annual movement in prices and therefore capital growth will be similar and at times higher than similar housing stock not affected by aircraft noise.

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