ANCCG Meeting

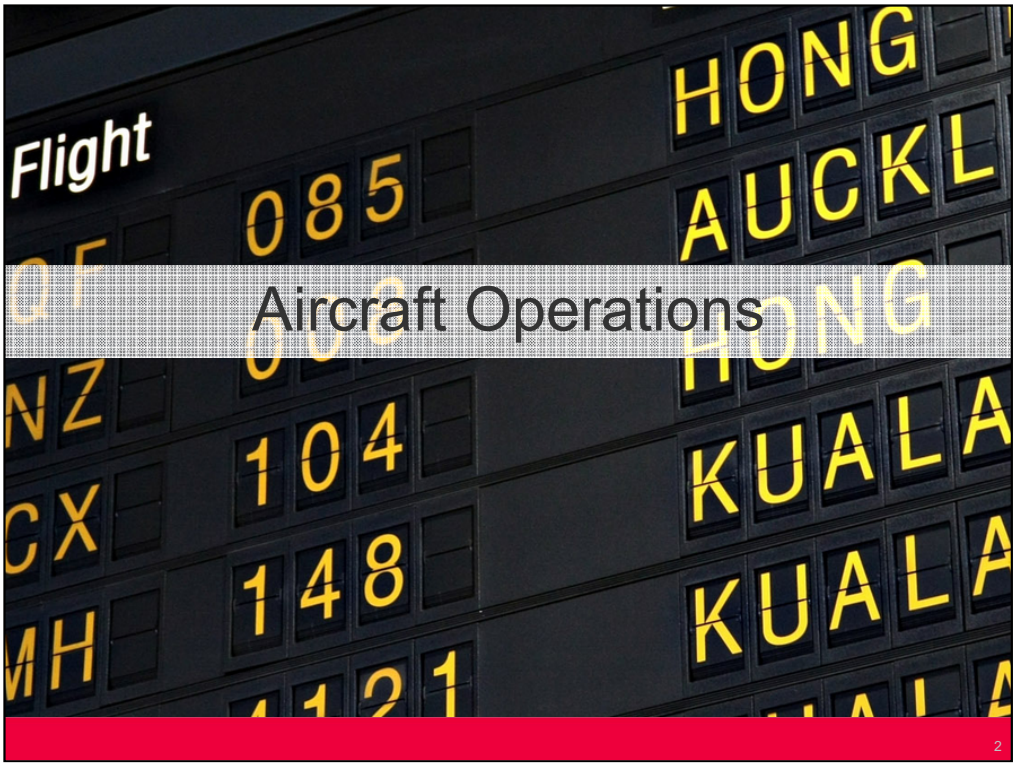
Monitoring Period

August 2017 – October 2017

Meeting: 6 December 2017

MARSHALL DAY Acoustics

NB: Glossary of terminology given in Appendix A



Aircraft Operations

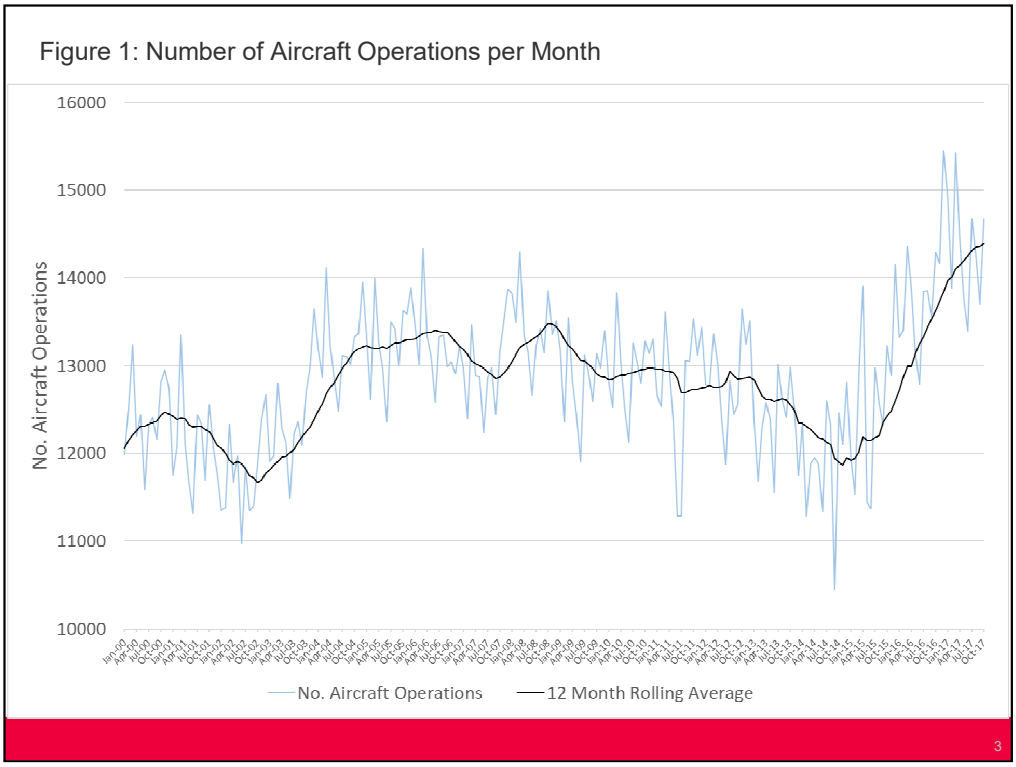


Figure 1 shows the number of aircraft operations per month since the year 2000 (blue line) and the 12 month rolling average (black line).

Aircraft operations have fluctuated over the years with a dip in 2002 and 2014.

Since 2015 aircraft operations have increased steadily.

The number of aircraft operations in the three month period August 2017 to October 2017 has increased by 2% when compared to the same period last year.

Daytime operations have increased by 3% and night-time operations have decreased by 2% when compared to the same period last year.

Table 1: Summary of Aircraft Operations

Operation	Total	Day	Night
Arrivals	21,481	18,387	3,094
Departures	21,086	19,293	1,793
Circuit	61	58	3
Total	**42,628**	**37,738**	**4,890**

Table 2: Average Daily Aircraft Operations

Total	Day	Night
463	410	53

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Table 1 shows a breakdown of aircraft operations in the three month period August 2017 to October 2017.

Table 2 shows that there were on average 463 aircraft operations that occurred per day (24 hour period), 53 of these were at night-time.

Figure 2: Aircraft Operations by Time

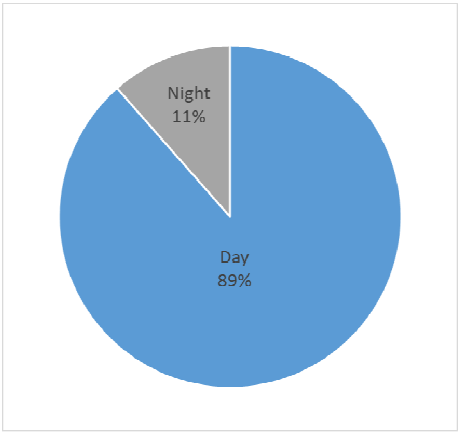

Figure 3: Aircraft Operations by Aircraft Type

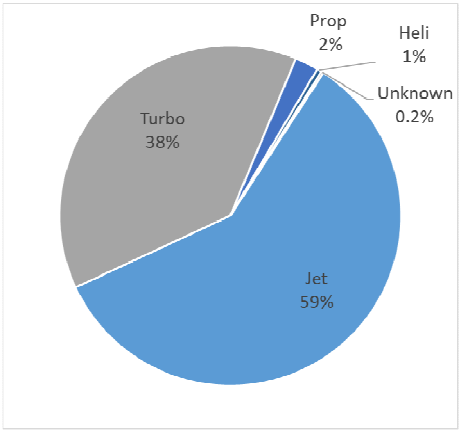

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Figure 2 shows the breakdown of aircraft operations by time of day in the three month period August 2017 to October 2017.

The majority (89%) of aircraft operations occurred in the daytime between 7am and 10pm and the remainder (11%) occurred at night-time.

Figure 3 shows the breakdown of aircraft operations by aircraft type in the three month period August 2017 to October 2017.

The majority (59%) of aircraft operations were jets with 38% being turboprops.

Propeller and helicopter aircraft made up less than 4% of the total aircraft operations during this period.

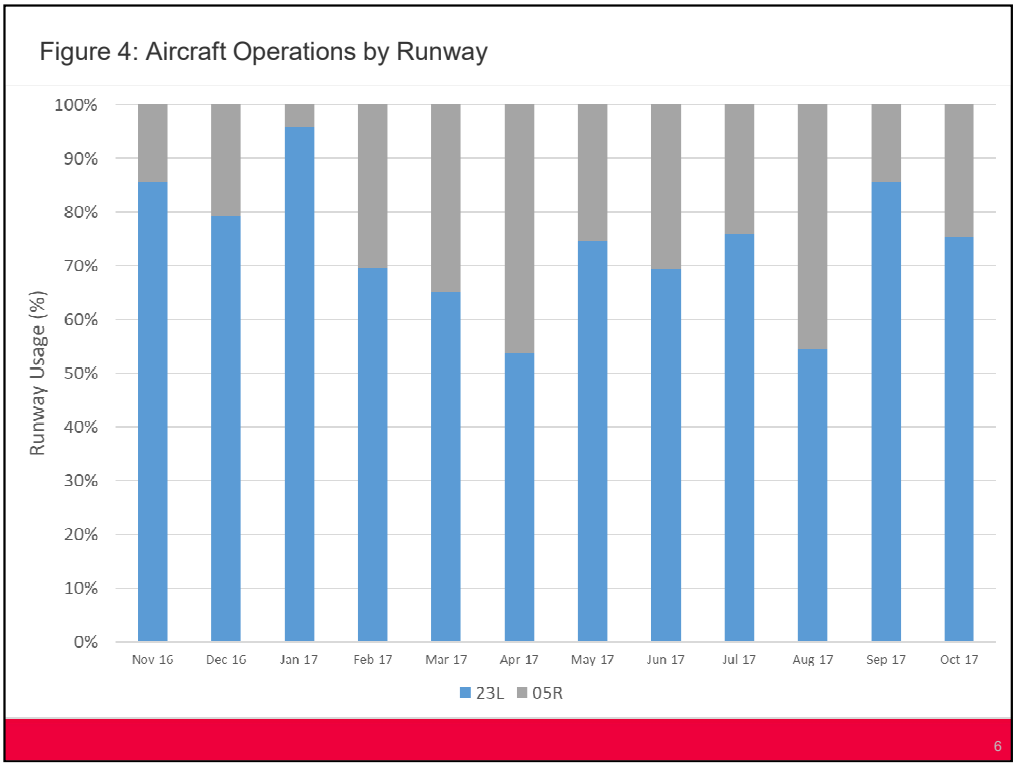

Figure 4 shows the percentage of aircraft operations that used each runway (23L and 05R) over the past 12 months.

Runway 23L is used when westerly winds prevail and Runway 05R is used when easterly winds prevail (refer glossary for explanation)

The historical average runway usage is RW23L 70%/RW05R 30%

The runway usage in the three month period August 2017 to October 2017 was RW23L 72%/RW05R 28% which is within the expected range for typical runway usage.

The runway use in the same quarter last year was RW23L 68%/RW05R 32%.


Flight Path Diagrams
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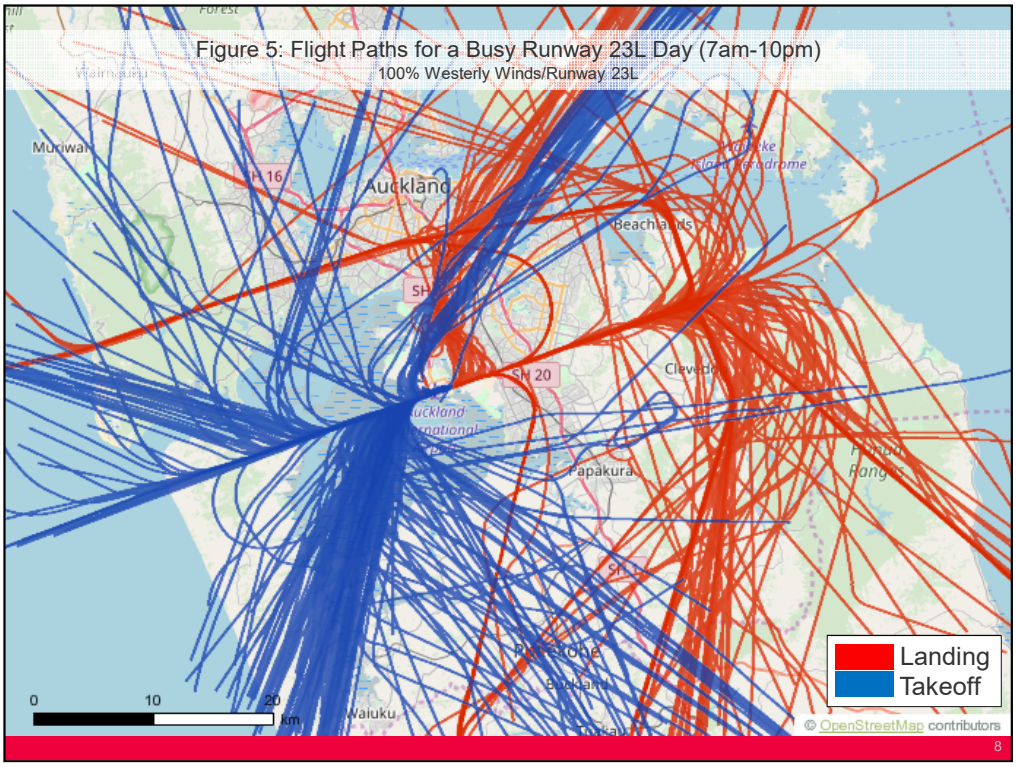


Figure 5 shows the daytime (7am-10pm) flight paths for Friday 20 October 2017, the busiest day in the three month period August 2017 to October 2017 when Runway 23L was primarily in use.

The red lines indicate arrivals and the blue lines indicate departures.

The runway usage during this day was Runway 23L (westerly) 100%.

There were 490 daytime flights on this day.

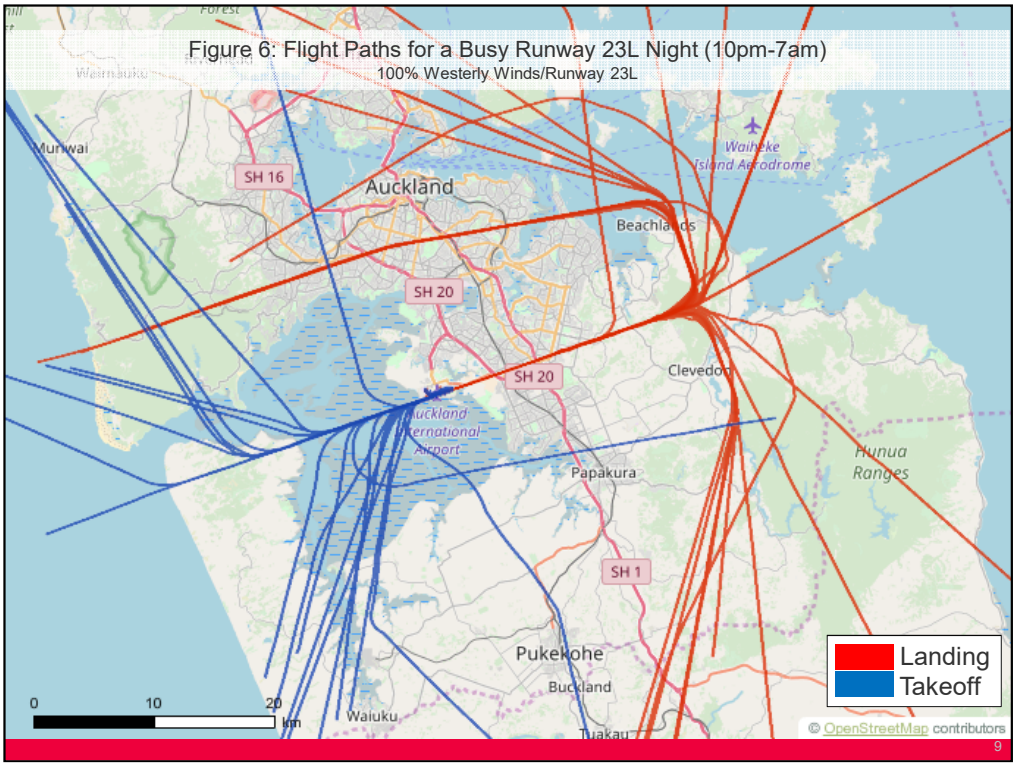


Figure 6 shows the night-time (10pm-7am) flight paths for Friday 20 October 2017, the busiest night in the three month period August 2017 to October 2017 when Runway 23L was primarily in use.

The red lines indicate arrivals and the blue lines indicate departures.

The runway usage during this day was Runway 23L (westerly) 100%.

There were 58 night-time flights on this day.

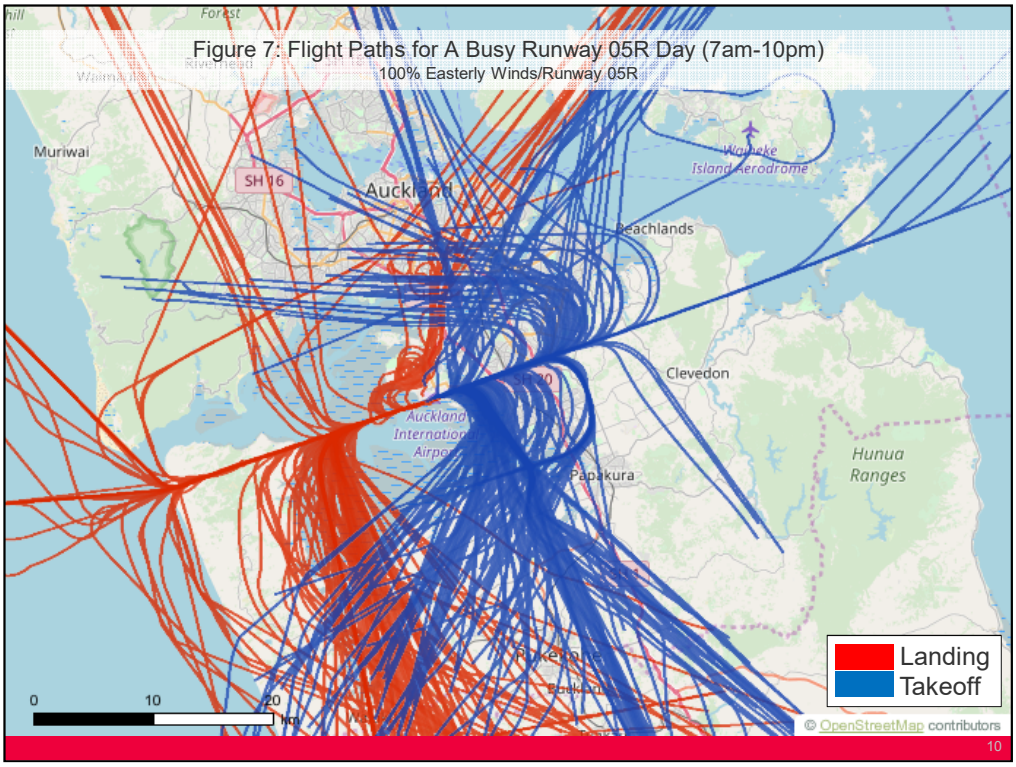


Figure 7 shows the daytime (7am-10pm) flight paths for Friday 25 August 2017, the busiest day in the three month period August 2017 to October 2017 when Runway 05R was primarily in use.

The red lines indicate arrivals and the blue lines indicate departures.

The runway usage during this day was Runway 05R (easterly) 100%.

There were 451 daytime flights on this day.

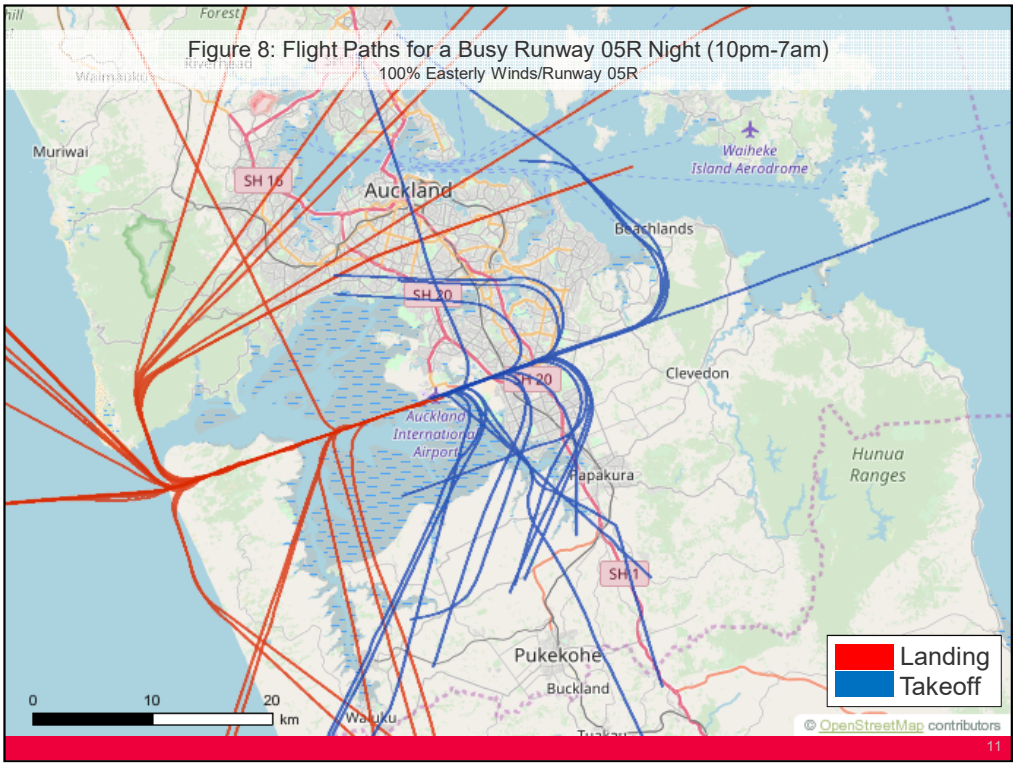


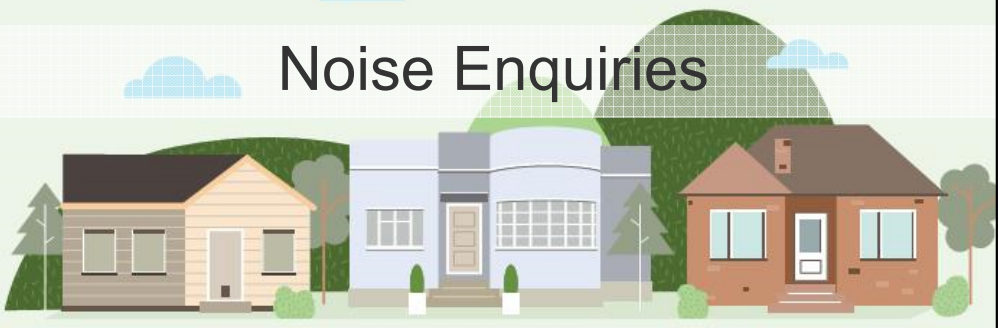
Figure 8 shows the night-time (10pm-7am) flight paths for Friday 25 August 2017, the busiest night in the three month period August 2017 to October 2017 when Runway 05R was primarily in use.

The red lines indicate arrivals and the blue lines indicate departures.

The runway usage during this day was Runway 05R (easterly) 100%.

There were 59 night-time flights on this day.

Noise Enquiries



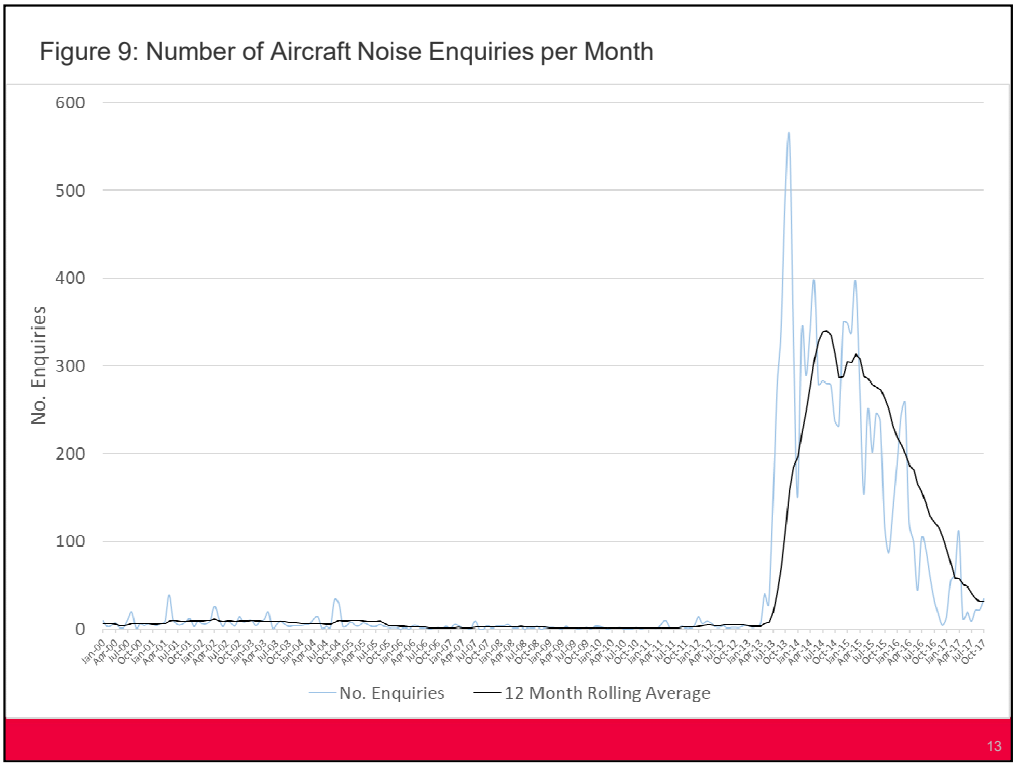


Figure 9 shows the total number of aircraft noise enquiries made per month since the year 2000 (blue line) and the 12 month rolling average (black line).

Aircraft noise enquiries were low up until 2013 when the number of enquiries increased from about 2 per month to a peak of 560 in November 2013 and have decreased steadily since then.

This increase in enquiries coincided with the 2012/13 SMART trials where community awareness to noise was heightened.

The number of noise enquiries in the three month period August 2017 to October 2017 has decreased by 58% from 184 to 77 when compared to the same period last year.

Table 3: Summary of Noise Enquiries

	Total	August	September	October
Number of Enquiries	77	21	22	34
Specific	*54*	*13*	*18*	*23*
Generic	*20*	*6*	*4*	*10*
Question	*3*	*2*	*0*	*1*
Number of People Enquiring	25	7	2	6

Note: Two people made 42% (32) of the total number of noise enquiries for the three month period. These people were located in Greenlane and Epsom.

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Table 3 shows a breakdown of the noise enquiries in the three month period August 2017 to October 2017.

A particular person, may have made several enquiries over time. These individual enquiries could have been regarding one specific aircraft operation or a more general enquiry which does not reference a specific aircraft operation.

There are two types of general enquiries, 'generic' and 'question'. The first relates to people lodging a general enquiry about aircraft noise rather than a specific event, the second relates to people enquiring to ask for more information about aircraft noise or management of noise. We therefore refer to;

- The number of 'enquirers' (no. of people who enquire),
- The number of 'generic' noise enquiries (e.g. " there was more aircraft noise last night")
- The number of 'question' noise enquiries (e.g. "can you tell me more about how noise is managed at the airport")
- The number of 'specific' event enquiries (e.g. "the flight at 6:25pm was noisy")

There were a total of 77 enquiries in the three month period August 2017 to October 2017, 70% related to specific aircraft events, 26% were generic enquiries and 4% were question enquiries.

The last row gives the number of people who enquired. Two people in Greenlane and Epsom made 42% (32) of the enquiries for the three month period.

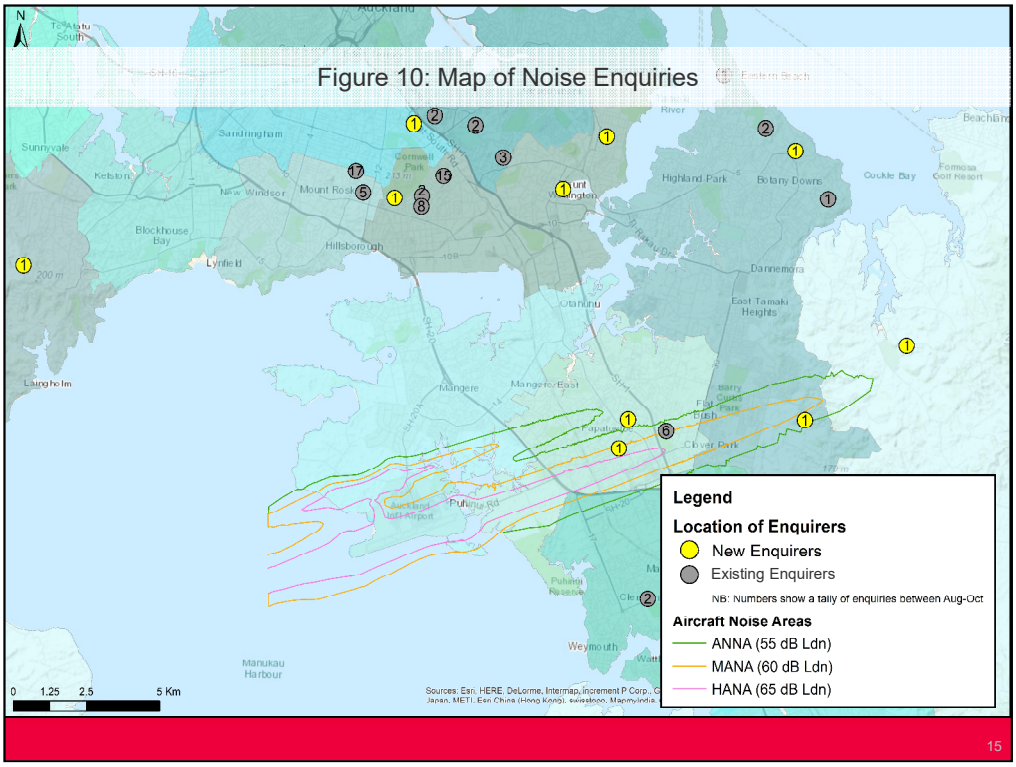


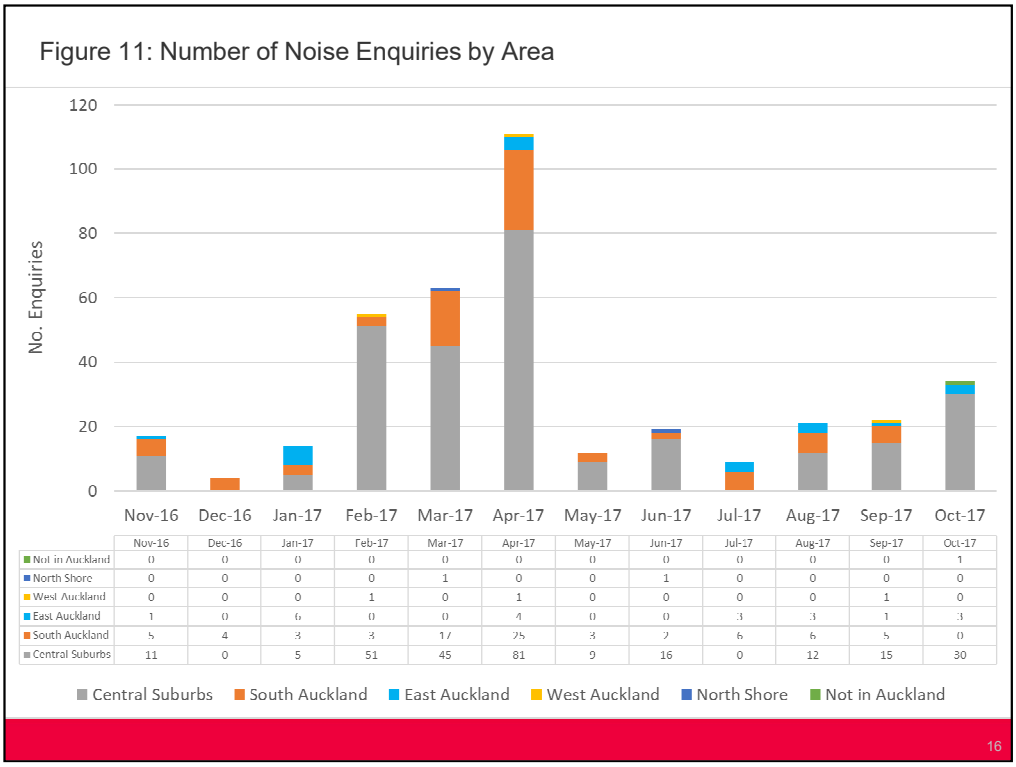
Figure 10 shows a map with the location of each enquirer.

Each point represents the location of a person who enquired in the three month period August 2017 to October 2017.

The color of the point represents whether it was an existing enquirer (grey - someone who has enquired before) or a new enquirer (yellow - someone who hasn't enquired before).

The numbers on top of each point give the number of enquiries made by each person in the three month period August 2017 to October 2017.

There is a cluster of enquiries in the Central Suburbs with some in East Auckland. There is also a cluster inside the Aircraft Noise Areas, the majority of which were related to the noise mitigation programme.



	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17
Not in Auckland	0	0	0	0	0	0	0	0	0	0	0	1
North Shore	0	0	0	0	1	0	0	1	0	0	0	0
West Auckland	0	0	0	1	0	1	0	0	0	0	1	0
East Auckland	1	0	6	0	0	4	0	0	3	3	1	3
South Auckland	5	4	3	3	17	75	3	2	6	6	5	0
Central Suburbs	11	0	5	51	45	81	9	16	0	12	15	30

Figure 11 shows the number of enquiries made by people residing in different areas of Auckland over the past 12 months.

In the three month period August 2017 to October 2017 most of the enquiries were made by people residing in the Central Suburbs with the remainder made by people residing in South and East Auckland. This is similar to previous months.

A list of which suburbs fall into each area is provided in Appendix C.

Figure 12: Noise Enquiries by Time

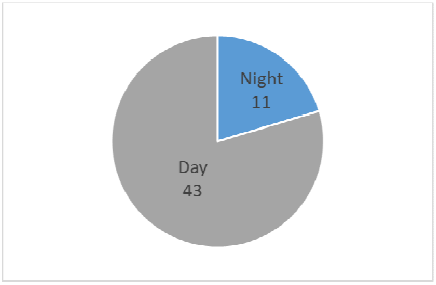


Figure 13: Noise Enquiries by Runway

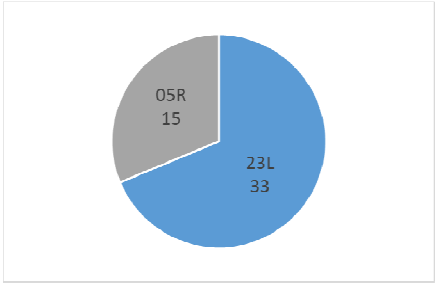


Figure 14: Noise Enquiries by Aircraft

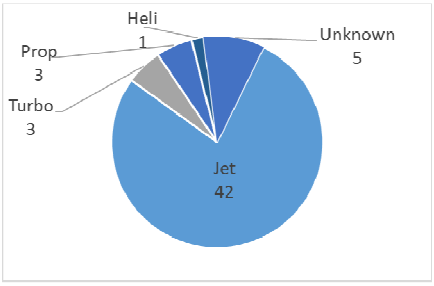
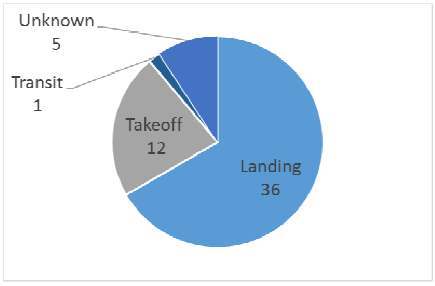


Figure 15: Noise Enquiries by Operation



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Figures 12-15 show a breakdown of the ‘specific’ aircraft noise enquiries made in the three month period August 2017 to October 2017.

Night-time flights made up 20% of the enquiries with the majority of enquiries relating to jet arrivals on Runway 23L.

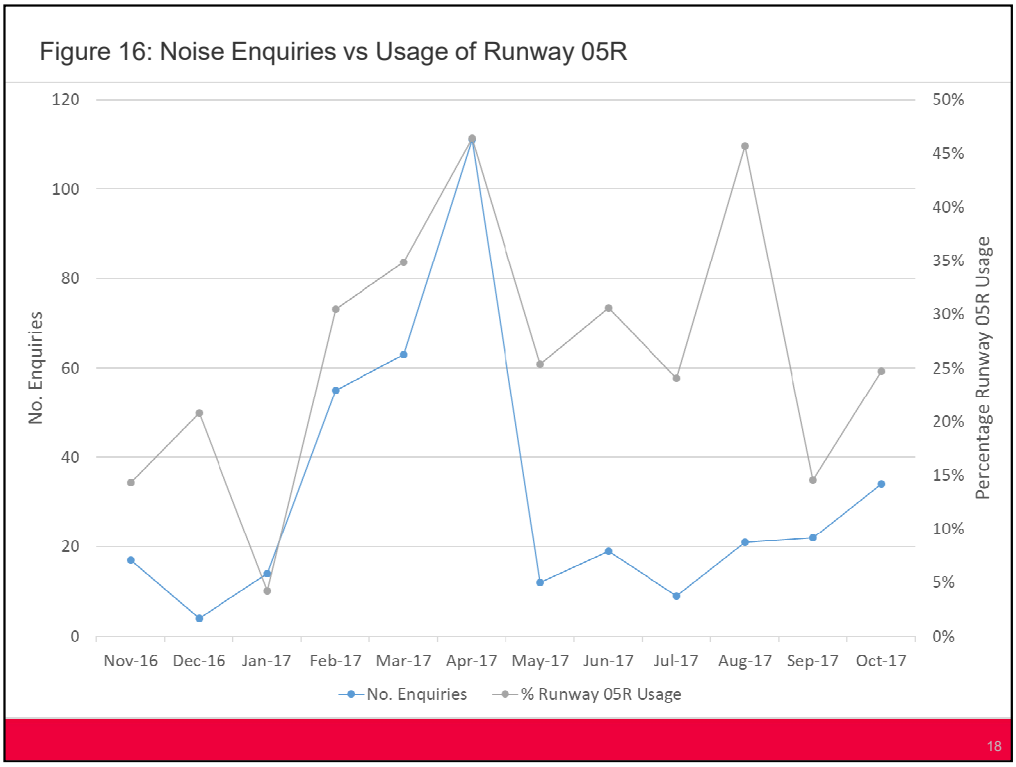

Figure 16 shows the number of noise enquiries received in the past 12 months compared to the usage of Runway 05R.

There is a correlation between the usage of Runway 05R and the number of enquiries.

Usage of Runway 05R is associated with easterly winds which cause departing aircraft to depart to the east over populated areas instead of over the Manukau Harbour (as occurs in the predominant westerly winds).

Departing aircraft are generally louder than arriving aircraft.

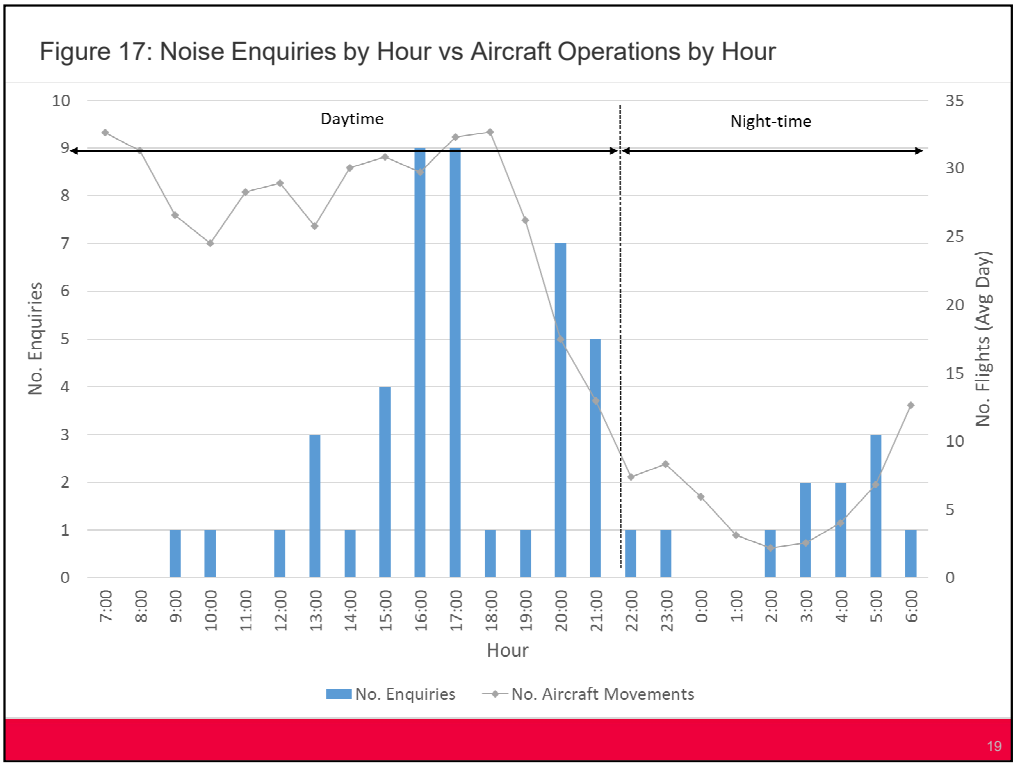

Figure 17 shows the number of specific aircraft noise enquiries and the number of aircraft operations per hour.

The blue bars show the number of enquiries that related to an aircraft operation in each hour of the day in the three month period August 2017 to October 2017.

The gray line shows the average daily aircraft operations that occurred in each hour of the day during this period.

Most of the enquiries are about aircraft in the daytime with some about night-time flights.

There is a peak in the number of enquires around 4-5pm with another peak around 8-9pm, the rest are spread throughout the day.

There is some correlation between the number of aircraft operations and the number of enquiries.

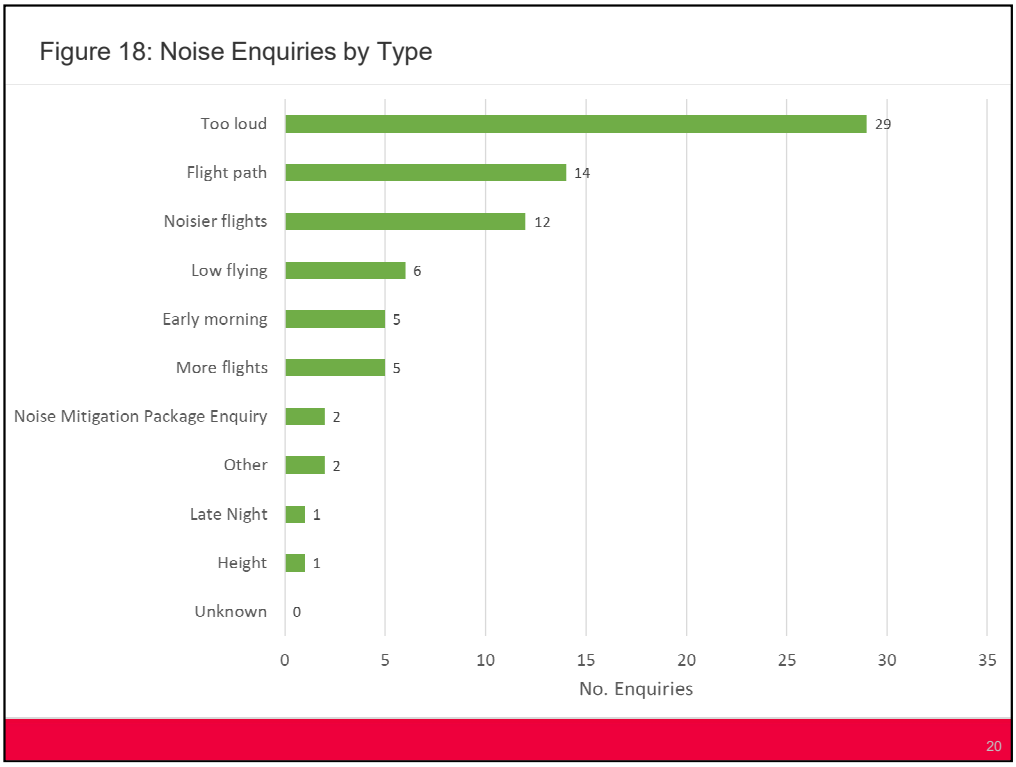

Figure 18 shows the reason for each noise enquiry. This includes generic and specific enquiries.

Aircraft operations being too loud was the main reason for the enquiry (38%) in the three month period August 2017 to October 2017.

Changes to the flight paths and aircraft becoming noisier were the second and third most prevalent reason.

For the same period last year aircraft operations being too loud was also the main reason for the enquiry.

A full description of each cause is given in Appendix B.

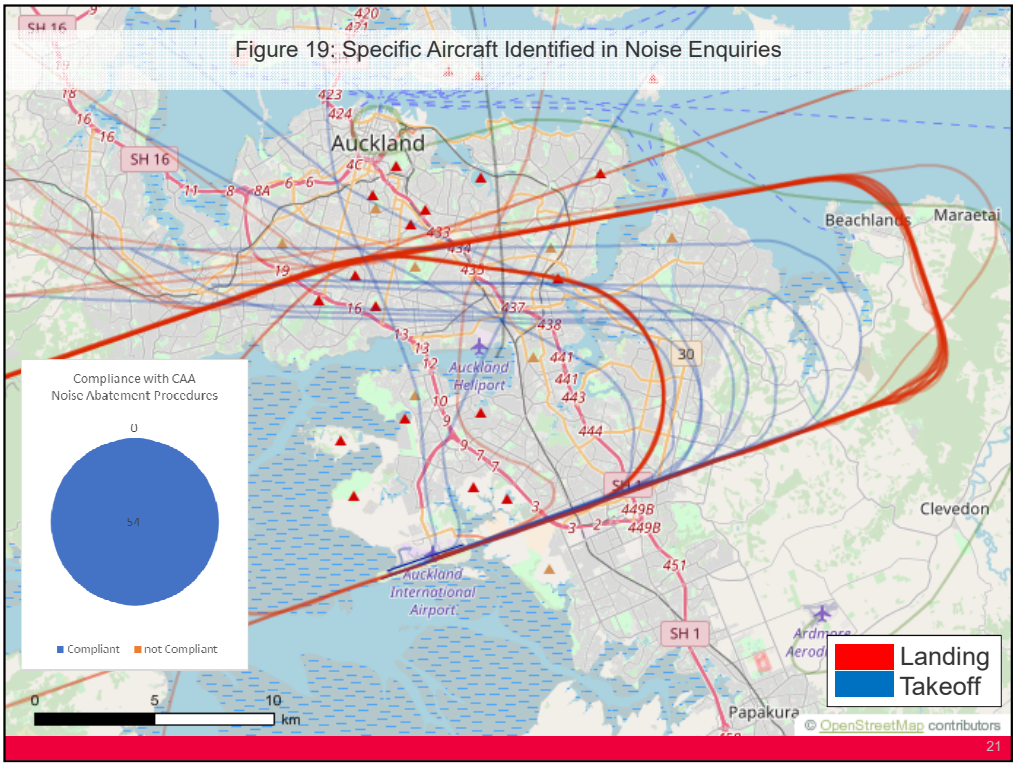

Figure 19 shows the flight paths for specific aircraft identified in noise enquiries for the three month period August 2017 to October 2017.

The red lines indicate arrivals and the blue lines indicate departures.

There were 54 noise enquiries that related to specific aircraft during this period.

All 54 specific aircraft events have been reviewed and all of them complied with the Civil Aviation Authority Noise Abatement Procedures.

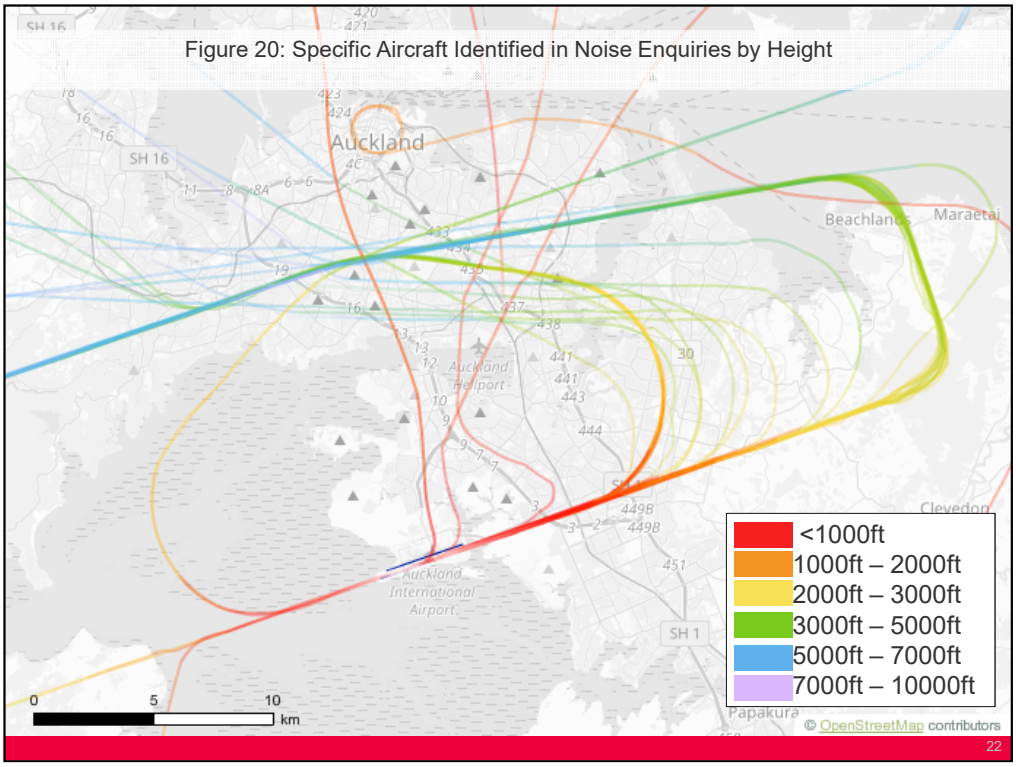

Figure 20 shows the flight paths for the 54 specific aircraft identified in noise enquiries for the three month period August 2017 to October 2017.

The flights paths are shown in terms of altitude.


Noise Monitoring
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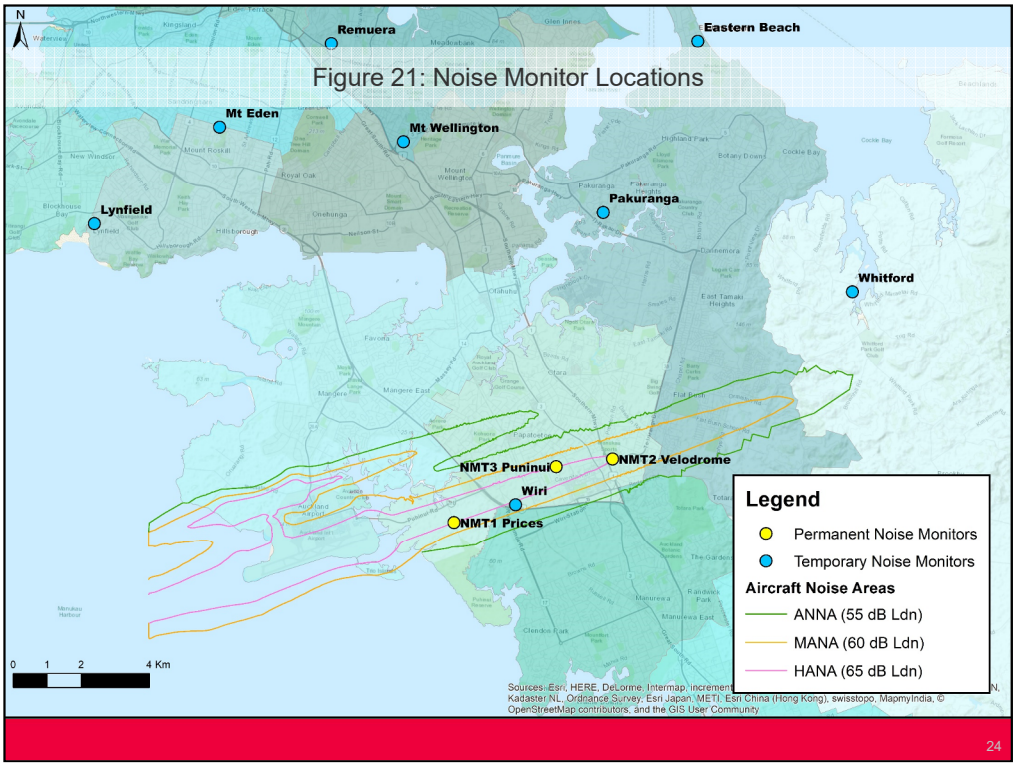

Figure 21 shows the location of Auckland Airport's three permanent and eight temporary noise monitors.

All of the permanent noise monitors are located on the outer boundary of the HANA which is set at 65 dB L_{dn} for future aircraft operations.

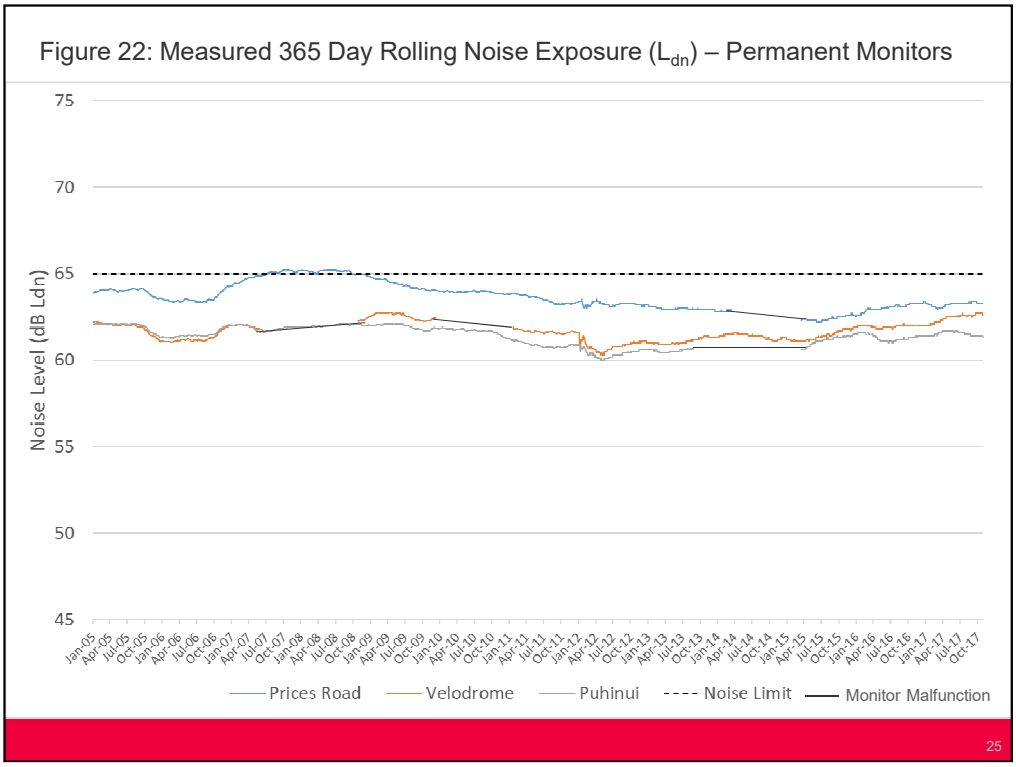

Figure 22 shows the rolling 365 day Noise Exposure (L_{dn}) at the permanent noise monitors since January 2005.

The noise limit in the District Plan is 65 dB L_{dn} (rolling 365 day) at the boundary of the HANA.

The rolling 365 day L_{dn} is the average L_{dn} noise level over 365 days calculated each day and is the overall average L_{dn} for the 365 days preceding and including the day of the calculation.

For example the point for 31 December 2005 represents the average L_{dn} noise level from 1 January 2005 to 31 December 2005.

The rolling 365-day L_{dn} is below the 65 dB L_{dn} noise limit in the three month period August 2017 to October 2017.

The current noise levels have decreased by 0.7 decibels at Puhinui School compared to the same quarter last year.

The current noise level are 0.1 decibels higher than the same quarter last year at Prices Rd and 0.6 decibels higher at the Velodrome.

The current noise levels are 1-2 decibels lower than in 2007/2008 when noise levels were highest.

A change in noise level of 1 to 2 dB is not generally perceptible to the human ear.

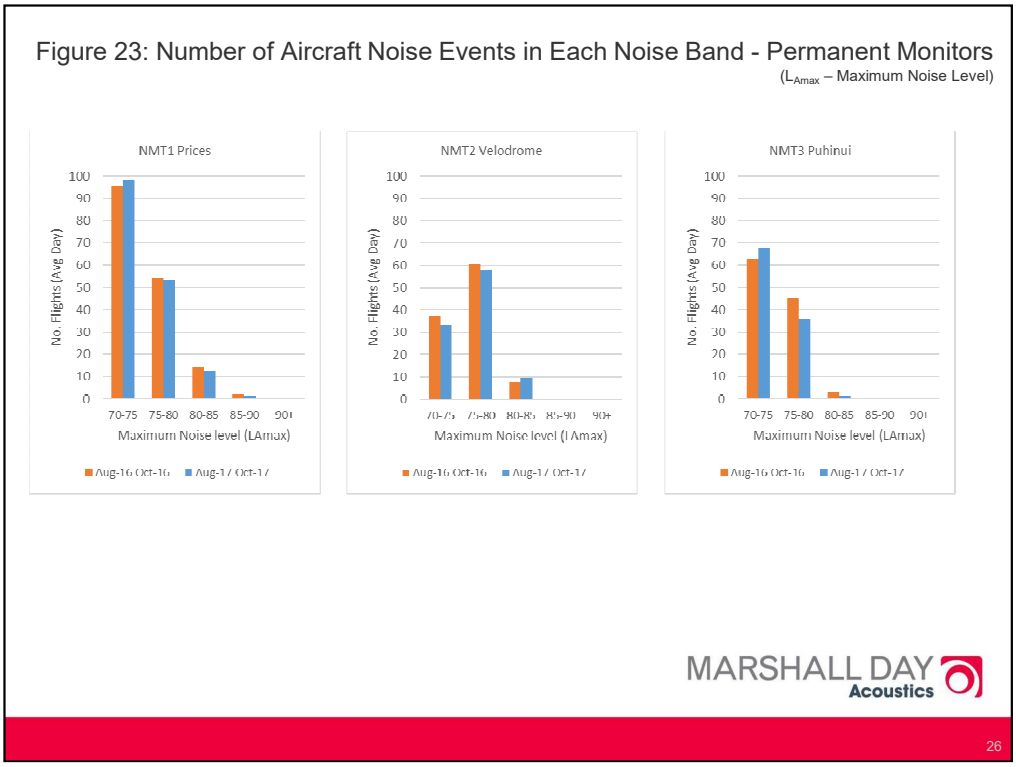

Figure 23 shows the average daily number of aircraft that overflew each permanent noise monitor in each noise band in the three month period August to October in 2016 (Orange bars) and 2017 (Blue bars).

L_{Amax} is the maximum noise level experienced as an aircraft overflies a monitor.

Aircraft noise events over 70-75 L_{Amax} start to become disturbing inside houses with windows open as they have the potential to interfere with watching tv, talking etc.

The permanent noise monitors receive 101-166 events above 70 L_{Amax} per day.

Table 4: Correlation of Aircraft Operations with Noise Events – Permanent Monitors

	NMT1 Prices	NMT2 Velodrome	NMT3 Puhinui
No. Aircraft Operations	19,935	12,974	14,043
No. Noise Events	17,560	9,410	13,505
Correlation	88%	73%	96%

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Table 4 shows the number of aircraft that flew in the vicinity of each permanent noise monitor and the number of aircraft noise events that were correlated with an aircraft flyover in the three month period August 2017 to October 2017.

Generally a noise monitor is unable to pick up each and every noise event due to ambient noise, inclement weather or other factors.

This table shows how well each noise monitor is performing in correlating aircraft noise events.

In terms of noise compliance, the aircraft that are missed are the lower noise level events and wont have any effect on the overall noise level.

The Velodrome monitor correlated a lower number of the aircraft flyovers. This is due to higher ambient noise levels in this area from State Highway 1 which mean quieter noise events are not triggered.

Table 5: Temporary Noise Monitor Summary of Measured Aircraft Events

	Date Deployed	Days in Field	Measured L_{dn}	Average L_{Amax}
Mt Eden	1-Apr-15	944	40	62
Lynfield	2-Apr-15	943	36	59
Pakuranga	9-Apr-15	936	41	66
Mt Wellington	17-Apr-15	928	40	66
Whitford	10-Jun-15	874	40	60
Eastern Beach	11-Jun-15	873	42	61
Remuera	19-Apr-16	560	35	59
Wiri	2-May-17	182	61	77

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Table 5 gives a summary of the measured noise levels at each temporary noise monitor since deployment (up until 31 October 2017).

Most of the temporary noise monitors have been deployed for around two and a half years with the noise monitor in Remuera deployed later in 2016 and the noise monitor in Wiri deployed in mid 2017.

The measured L_{dn} for aircraft noise ranges from 35-42 dB L_{dn} across the various temporary monitor locations, with the exception of the noise monitor in Wiri where noise levels were 61 dB L_{dn}.

New Zealand Standard NZS 6805 states that areas exposed to noise levels below 55 dB L_{dn} or less are suitable for residential development. The noise levels measured at the temporary noise monitors are 13-20 decibels below the 55 dB L_{dn} New Zealand Standard, with the exception of the noise monitor in Wiri.

The noise levels measured at the Wiri noise monitor are 6 decibels above the NZS 6805 guideline which is why this noise monitor is located within the Moderate Aircraft Noise Area.

The average L_{Amax} ranges from 59-66 dB L_{Amax} across the various monitors with the exception of the noise monitor in Wiri where noise levels were 77 dB L_{Amax}.

The average L_{Amax} is calculated by averaging the maximum level from all of the

individual aircraft noise events during the monitoring period.

The L_{Amax} differs for each aircraft operation depending on the aircraft type, type of operation etc.

Aircraft noise events over 70-75 L_{Amax} start to become disturbing inside houses with windows open as they have the potential to interfere with watching tv, talking etc.

There were less than 2 flyovers recorded at the temporary monitors above 70 dB L_{Amax} apart from the noise monitor in Wiri which had 85 noise events above 75 dB L_{Amax}.

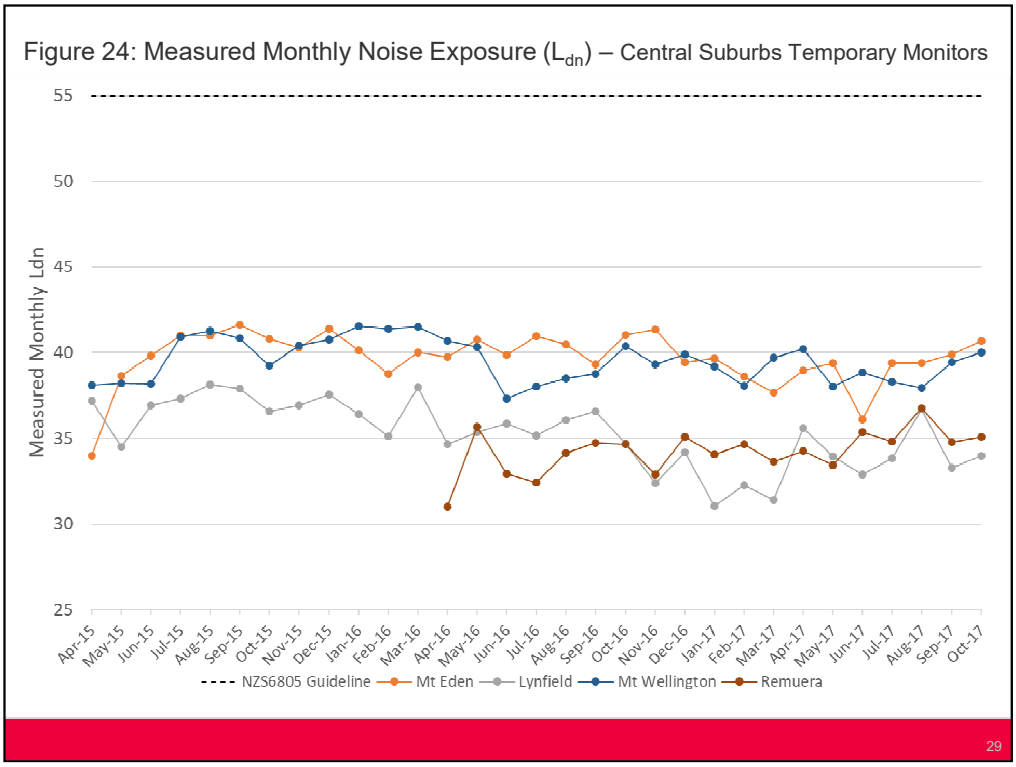

Figure 24 shows the monthly Noise Exposure (L_{dn}) trends for aircraft noise at the temporary noise monitors in the Central Suburbs since their deployment.

The L_{dn} fluctuates month on month by 4-8 decibels at each noise monitor depending on aircraft operations, wind direction and other factors.

There are no significant trends in the data.

The measured L_{dn} for aircraft noise ranges from 35-40 dB L_{dn} across the Central Suburb monitor locations.

New Zealand Standard NZS 6805 states that areas exposed to noise levels below 55 dB L_{dn} or less are suitable for residential development.

The noise levels measured at the temporary noise monitors in the Central Suburbs are 15-20 decibels below this level.

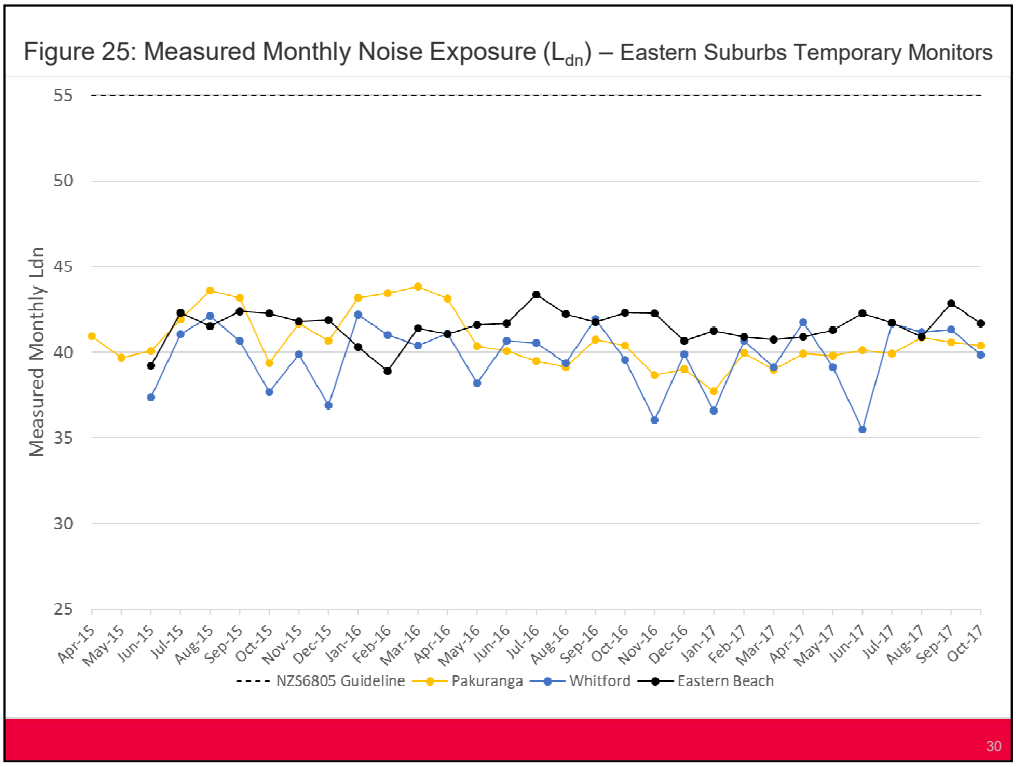

Figure 25 shows the monthly Noise Exposure (L_{dn}) trends for aircraft noise at the temporary noise monitors in East Auckland since their deployment.

The L_{dn} fluctuates month on month by 4-7 decibels at each noise monitor depending on aircraft operations, wind direction and other factors.

There are no significant trends in the data.

The measured L_{dn} for aircraft noise ranges from 40-42 dB L_{dn} across the various monitor locations.

New Zealand Standard NZS 6805 states that areas exposed to noise levels below 55 dB L_{dn} or less are suitable for residential development.

The noise levels measured at the temporary noise monitors are 13-15 decibels below this level.

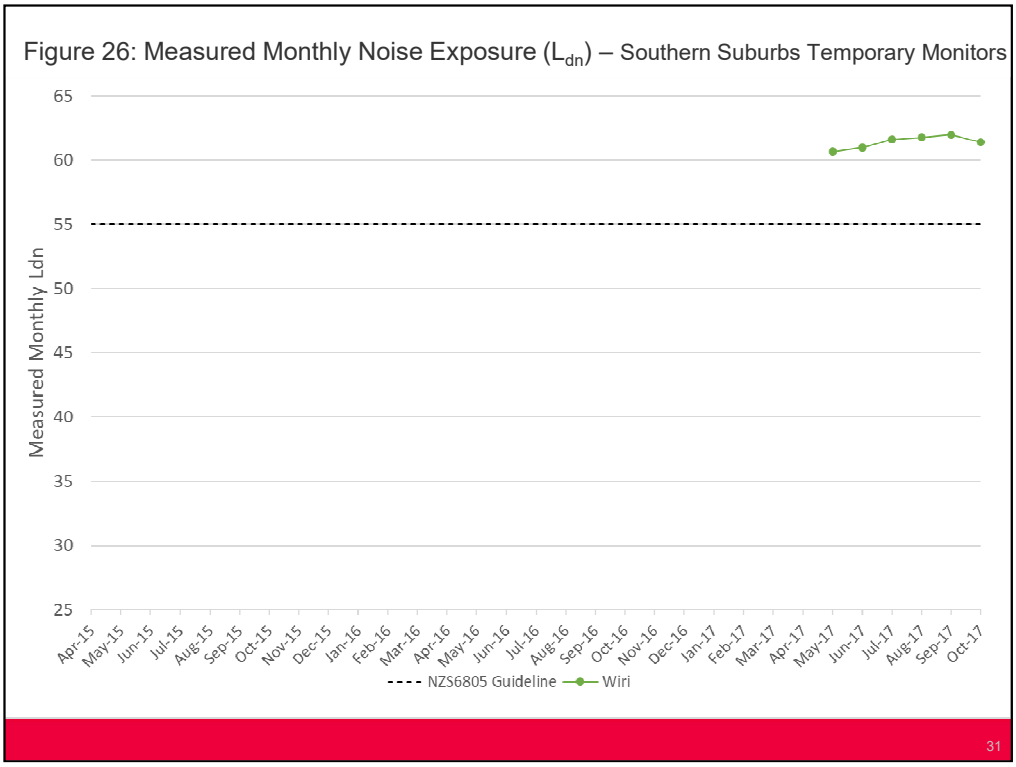

Figure 26 shows the monthly Noise Exposure (L_{dn}) trends for aircraft noise at the temporary noise monitor in South Auckland since it's deployment.

The L_{dn} fluctuates month on month by around 1 decibel depending on aircraft operations, wind direction and other factors.

There are no significant trends in the data.

The measured L_{dn} for aircraft noise is 61 dB L_{dn}.

New Zealand Standard NZS 6805 states that areas exposed to noise levels below 55 dB L_{dn} or less are suitable for residential development.

This noise levels measured at the Wiri noise monitor is 6 decibels above the NZS 6805 guideline which is why this noise monitor is located within the Moderate Aircraft Noise Area.

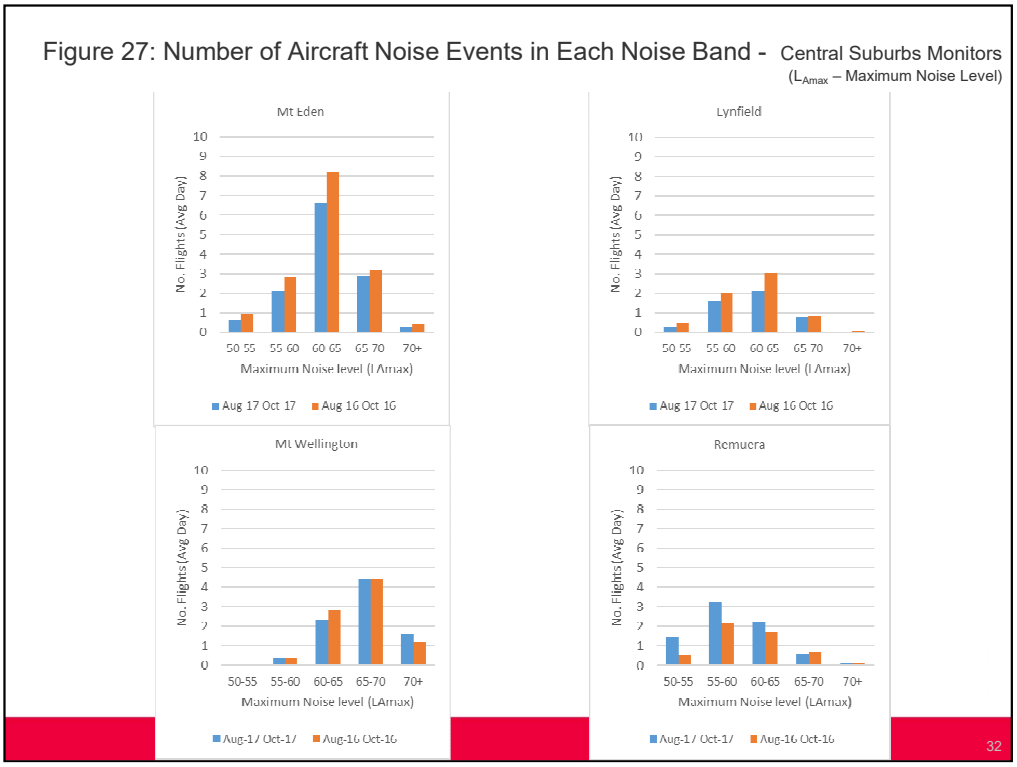

Figure 27 shows the average daily number of aircraft that overflew each of the Central Suburbs temporary noise monitors in each noise band in the three month period August to October in 2016 (Orange bars) and 2017 (Blue bars).

L_{Amax} is the maximum noise level experienced as an aircraft overflies a monitor.

Aircraft noise events over 70-75 L_{Amax} start to become disturbing inside houses with windows open as they have the potential to interfere with watching tv, talking etc.

The temporary noise monitors receive less than two events above 70 L_{Amax} per day.

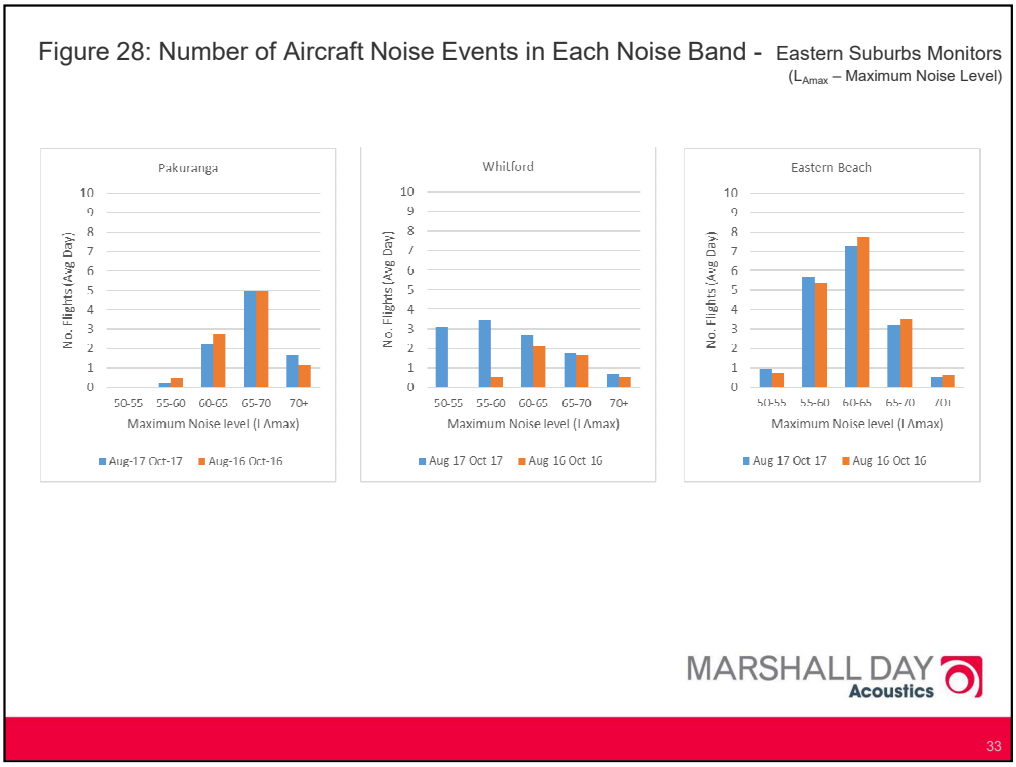

Figure 28 shows the average daily number of aircraft that overflew each of the Eastern Suburbs temporary noise monitors in each noise band in the three month period August to October in 2016 (Orange bars) and 2017 (Blue bars).

L_{Amax} is the maximum noise level experienced as an aircraft overflies a monitor.

Aircraft noise events over 70-75 L_{Amax} start to become disturbing inside houses with windows open as they have the potential to interfere with watching tv, talking etc.

The temporary noise monitors receive less than two events above 70 L_{Amax} per day.

Figure 29: Number of Aircraft Noise Events in Each Noise Band - Southern Suburbs Monitors
(L_{Amax} – Maximum Noise Level)

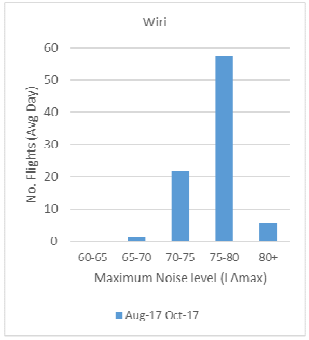

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Figure 29 shows the average daily number of aircraft that overflew the Wiri temporary noise monitor in each noise band in the three month period August to October 2017 (Blue bars).

L_{Amax} is the maximum noise level experienced as an aircraft overflies a monitor.

Aircraft noise events over 70-75 L_{Amax} start to become disturbing inside houses with windows open as they have the potential to interfere with watching tv, talking etc.

The Wiri noise monitor receives approximately 85 events above 70 L_{Amax} per day.


Engine Testing
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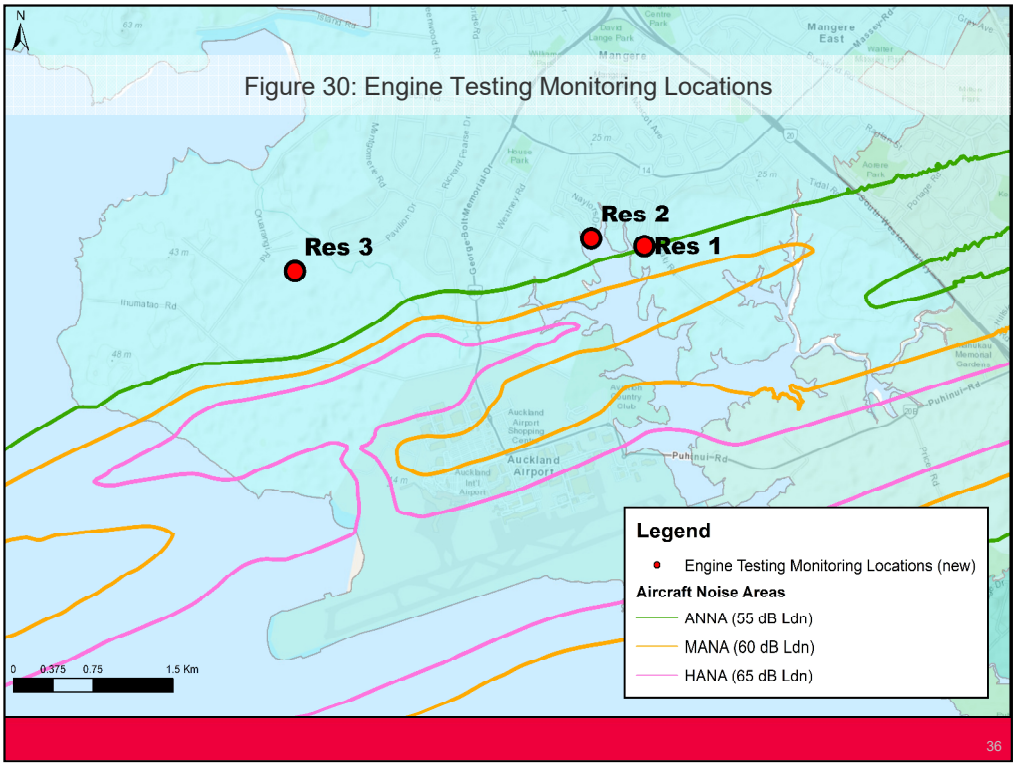


Figure 30 shows the three locations where compliance with the engine testing noise rule is calculated.

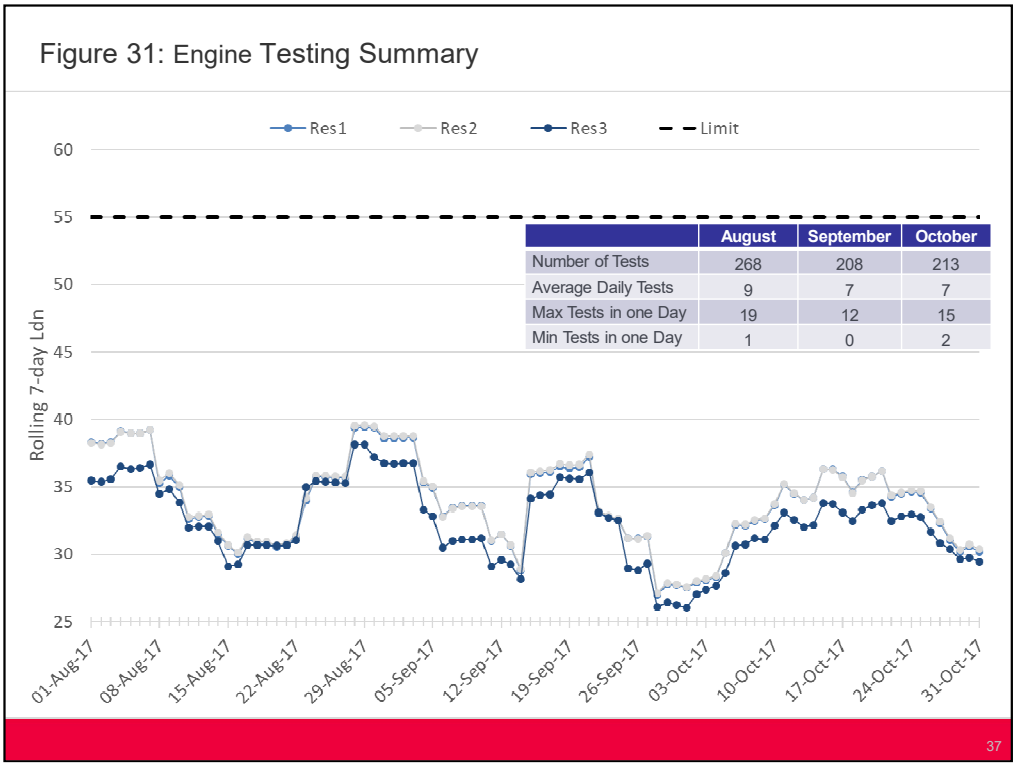


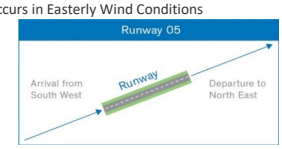
Figure 31 shows the rolling 7 day average noise level for engine testing activity at the airport in the three month period August 2017 to October 2017.

The District Plan noise limit for engine testing activity is 55 dB L_{dn} (7 day rolling).

The engine testing noise levels were compliant with the 55 L_{dn} noise limit.

The Table insert shows the maximum, minimum and average number of engine tests performed on an average day in each month along with the total number of tests completed in each month.

Appendix A: Glossary of Terminology

Term	Definition
Daytime	The period from 7:00am to 10:00pm
Night-time	The Period from 10:00pm to 7:00am
Runway 23L/Runway 05R	Occurs in Westerly Wind Conditions  Occurs in Easterly Wind Conditions 
Enquiry Type	
"Specific" enquiry	Enquiries relating to a specific aircraft operation.
"Generic" enquiry	Enquiries that don't relate to a specific aircraft operation but relate to noise in general.
"Question" enquiry	An enquiry to find out more information about noise related topics.
"Aircraft" Noise	Noise that is from aircraft operations only.
"Ambient" Noise	Noise that is from general ambient noise sources (cars, wind etc.). Excludes noise from aircraft operations.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
L_{dn} – Noise Exposure	The average A-weighted noise level over a day/month/year with a 10 dB penalty applied to the night-time (10pm – 7am).
L_{Amax} – Maximum Noise Level	The highest A-weighted noise level which occurs during an aircraft operation.
ANNA	Aircraft Noise Notification Area – Set at 55 dB L_{dn}
MANA	Moderate Aircraft Noise Area – Set at 60 dB L_{dn}
HANA	High Aircraft Noise Area – Set at 65 dB L_{dn}

Appendix B: Noise Enquiry Type

Cause	Description
Low flying	Aircraft flying at a low altitude
Too loud	Aircraft making too much noise
Early morning	Aircraft flying in the early morning
Late night	Aircraft flying late at night or overnight
Height	Aircraft flying higher or lower than usual
More flights	More aircraft operations than usual
Noisier flights	Aircraft are noisier than usual
Flight path	Aircraft flying on a different flight path than usual
Other	The disturbance is different from those listed
Unknown	Cause not stated
Noise Mitigation Package Enquiry	Enquiry relating to the Noise Mitigation Packages

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Appendix C: Suburbs by Area

Suburb	Area
Alfriston	South Auckland
Anawhata	West Auckland
Beachlands	East Auckland
Bucklands Beach	East Auckland
Clover Park	South Auckland
Cockle Bay	East Auckland
Cornwallis	West Auckland
East Tamaki Heights	East Auckland
Ellerslie	Central Suburbs
Epsom	Central Suburbs
Flat Bush	East Auckland
Glendowie	Central Suburbs
Greenlane	Central Suburbs
Grey Lynn	Central Suburbs
Half Moon Bay	East Auckland
Herne Bay	Central Suburbs
Howick	East Auckland
Karaka	South Auckland
Mangere	South Auckland
Mangere Bridge	South Auckland
Manukau	South Auckland
Manurewa	South Auckland
Meadowbank	Central Suburbs
Mellons Bay	East Auckland
Milford	North Shore
Mount Eden	Central Suburbs
Mount Roskill	Central Suburbs
Mount Wellington	Central Suburbs
Muriwai	West Auckland
Northpark	South Auckland
One Tree Hill	Central Suburbs
Onehunga	Central Suburbs
Onewhero	South Auckland
Otahuhu	South Auckland
Otara	South Auckland
Pakuranga Heights	East Auckland
Panmure	Central Suburbs
Papatoetoe	South Auckland
Point Chevalier	Central Suburbs
Point England	East Auckland
Pollok	South Auckland
Randwick Park	South Auckland
Remuera	Central Suburbs
Saint Heliers	Central Suburbs
Sandringham	Central Suburbs
Shelly Park	South Auckland
Somerville	South Auckland
Takanini	West Auckland
Te Atatu South	West Auckland
The Gardens	South Auckland
Titirangi	West Auckland
Totara Heights	South Auckland
Totara Vale	South Auckland
Waitakere	West Auckland
Waiuku	South Auckland
Wattle Downs	South Auckland
Westmere	Central Suburbs
Weymouth	South Auckland
Whanganui	Not in Auckland
Whangaparaoa	Not in Auckland