



HEATHROW COMMUNITY NOISE FORUM

Bracknell and Wokingham flight path
analysis report

April 2016

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EXECUTIVE SUMMARY

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Executive summary

As part of the engagement between Heathrow Airport Limited and the Heathrow Community Noise Forum, flight paths through a series of penetration gates around the airport have been analysed. One of these gates extended approximately 28km from Camberley in the south to north of Marlow in the north. Following the publication and discussion of a draft report describing this gate, a request was made for a more focused analysis on the southern half of the gate, centred on Bracknell to the east and Wokingham to the west, and extending 5.5km to the north and south, 11km extent in total. In addition, as time has passed since the additional analysis and more data are now available, the analysis period has been amended to cover the period 1 January 2011 to 29 February 2016 to ensure the results are as current and relevant as possible. This report describes the analysis and associated conclusions relating to this Bracknell and Wokingham gate.

During the analysis period, for departures the gate operated in the westerly direction on average for between 60% and 70% of the time, operated in the easterly direction on average between 20% and 30% of the time and has a mixture of westerly and easterly operations for approximately 10% of the time.

For arrivals, the gate operated in the westerly direction between approximately 50% and 60% of the time and on easterlies between 25% and 30% of the time. For the remainder of the time, the gate was either not crossed by arrival traffic (10% to 15% of the time) or operated in a mix of directions. The volume of traffic crossing the gate on easterly operations is approximately three times the volume crossing on westerly operations, typically 300 flights per day as opposed to 100 flights per day.

Executive summary

For **easterly departures**, the Bracknell and Wokingham gate is crossed by traffic using the easterly Compton (CPT) standard instrument departure route (SID). The volume of the easterly daily departure traffic has a cyclical pattern with higher levels in summer than in winter. The average daily departure traffic through the gate on easterly days has increased from 75 flights per easterly day in 2011 to 108 flights per day in 2015. During the first two months of 2016, the average volume was 93 flights per easterly day. As only winter data is available for 2016, this does not necessarily imply a downwards trend in traffic volume.

The lateral centre of gravity (mean position) of the easterly departure traffic swath has shifted north from 500m to the right of gate centre to 2500m to the right of gate centre. This occurred mainly as a step change in mid-2014 due to realignment of the CPT SID.

There is no trend on the height of the vertical centre of gravity of the easterly departure traffic, which has remained consistent at approximately 9500 feet from 2011 to 2016, although there is day-to-day variation above and below this average. The average daily minimum height for easterly departures shows an upwards trend from 2011 to 2016 from 6000 feet to just over 7000 feet.

The proportion of large aircraft in the easterly departure mix increased from 71% in 2011 to 78% in 2015 and 77% in 2016. A380s currently make up 2% of the total. The proportion of ultra long and long-haul destinations served by this easterly departure traffic has remained consistent from 2011 to 2016 at approximately 77% of the total.

Easterly departures are distributed across the day with a broad peak occurring between 10:00 hours and 14:00 hours with lower levels at other times. The peak level increased from 2014 to 2015.

Executive summary

For **westerly departures**, the Bracknell and Wokingham gate is crossed by the CPT and Southampton (SAM) SIDs travelling west. Crossings mainly occur at the northern end of the gate with a lower intensity of traffic across the remainder of the gate.

The volume of daily westerly departure traffic is cyclical, with higher volume in summer than winter. The average daily westerly departure traffic on westerly days has remained more or less constant. The volume was approximately 83 flights per westerly day in 2011 and was 87 flights per westerly day in 2015. The average so far for 2016 is 76 westerly departures per westerly day noting that this is winter traffic and volumes are typically lower in winter than summer.

The average lateral centre of gravity of the westerly departure traffic shifted south from 3500m to the right of gate centre to a point 2500m to the right of gate centre during the trials but returned to its original position after the trials finished. The trials resulted in traffic being concentrated in swaths at 3500m to the right (north) and 3000m and 5500m to the left (south) sides of gate centre in addition to the normal swath at 4900m to the right (north) of gate centre. There appears to have been a slight shift in the lateral centre of gravity towards the south in late 2015.

There is no trend on the height of the vertical centre of gravity of the westerly departure traffic, which has remained consistent at approximately 7500 feet from 2011 to 2016. However, there is considerable day-to-day variation and a cyclical pattern with departures higher in winter than in summer. The average minimum daily height for westerly departures is consistent at approximately 5000 feet but with day-to-day variations from 4000 feet to 6000 feet. There is evidence of a cyclical pattern in the minimum height: higher in winter than summer; particularly in 2013 and 2014. A number of flights are observed, particularly in 2011 and 2012, at very low heights of order 2000 feet to 3000 feet. These are generally technical flights to calibrate the Airport's landing systems.

Executive summary

The proportion of large aircraft in the **westerly departure** mix has increased from 53% in 2011 to 61% in 2015 and 60% in 2016: A380s are currently 2% of the total. The proportion of ultra-long haul traffic in the mix has increased from 9% to 14%, short-haul has remained constant at 42% and long haul has decreased from 47% to 44% between 2011 and 2016, indicating a switch from long haul to ultra-long haul destinations.

There is a broad peak in westerly departure traffic crossing the gate extending from 09:00 to 20:00 hours with lower levels from 06:00 to 09:00 and 20:00 to 23:30 hours.

There are two streams of **easterly arrivals** traffic crossing the gate. In the southern half of the gate, traffic flows west from the Ockham and Biggin stacks to loop round to approach the easterly runways. In the northern half of the gate, traffic flows east to approach the runways. Some flights will cross the gate twice, flowing west across the gate in the south then looping round to cross the gate in the north travelling east.

The daily volume of easterly arrival traffic crossing the gate on easterly days is decreasing, although there is considerable day-to-day variation. The average easterly arrival traffic through the gate has decreased from 2011 at 188 flights per easterly day to 175 flights per easterly day in 2015. The lower figure of 137 flights per easterly day observed for the first two months in 2016 only covers the two lowest volume winter months so it is not necessarily representative of the whole year. The volume also shows the cyclical summer:winter pattern, higher in summer than in winter.

The average lateral centre of gravity of the northerly easterly arrivals stream, flowing east to the runways, is approximately 4000m right of gate centre. The lateral centre of gravity of the southerly stream is approximately 3500m to the left of gate centre. Both of these centres of gravity have remained stationary from 2011 to 2016

Executive summary

The average vertical centre of gravity of the northerly **easterly arrival** stream is at approximately 4000 feet. The vertical centre of gravity of the southerly stream is approximately 5500 feet. Both vertical centres of gravity have remained consistent from 2011 to 2016 with no trend upwards or downwards. The average minimum height for the northerly easterly arrivals stream is very consistent at 3000 feet with little day-to-day variation. The average minimum height for the southerly arrivals stream is 4000 feet but with some day-to-day variation.

The proportion of large aircraft in the easterly arrivals mix has increased from 36% in 2011 to 42% in 2015 and 48% in 2016, with A380s making up 3% of the total. The proportion of ultra long and long-haul origins served by easterly arrivals traffic has increased from 36% in 2011 to 38% in 2015 and to 46% in 2016.

Easterly arrivals traffic volume is uniform from 06:00 to 21:30 hours with lower levels from 04:30 to 06:00 and after 21:30 hours. The early morning traffic comprises a high proportion of large aircraft.

Westerly arrival traffic crosses the gate flowing east to join the Ockham stack and is of low volume. This traffic crosses at the extreme southern end of the gate and is typically around two flights per day but with a high proportion of days with four to six flights per day and the occasional day with up to ten flights. The overall average daily arrival traffic through the gate on westerly days has remained more or less constant from 2011 to 2016 at approximately 2.5 westerly arrivals per westerly day.

The average lateral centre of gravity of the westerly arrival traffic is approximately 3500m to the left of gate centre although there is large scatter from day-to-day likely due to the small number of westerly arrival crossing the gate. The vertical centre of gravity for westerly arrival traffic is at approximately 11000 feet, again with large day-to-day scatter. Some very low flights are observed in 2011: these are technical flights used to calibrate the Airport's landing systems. The average daily minimum height for westerly arrivals is slightly above 10000 feet but with considerable day-to-day variation. The flights below 3000 feet are generally technical flights used to calibrate the airport's landing systems.

Because of the low volume of westerly arrivals crossing the gate detailed analysis has not been performed.

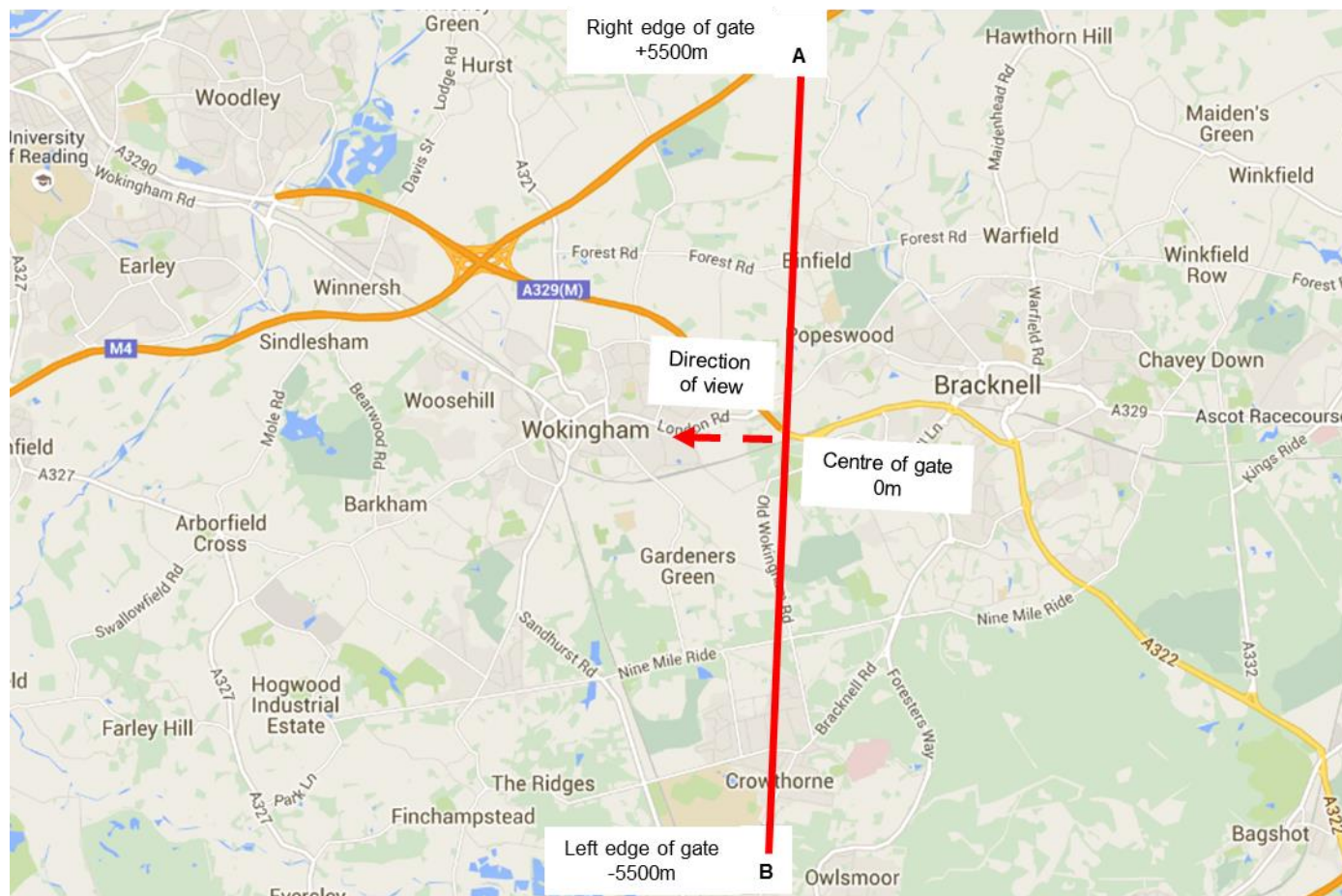


INTRODUCTION

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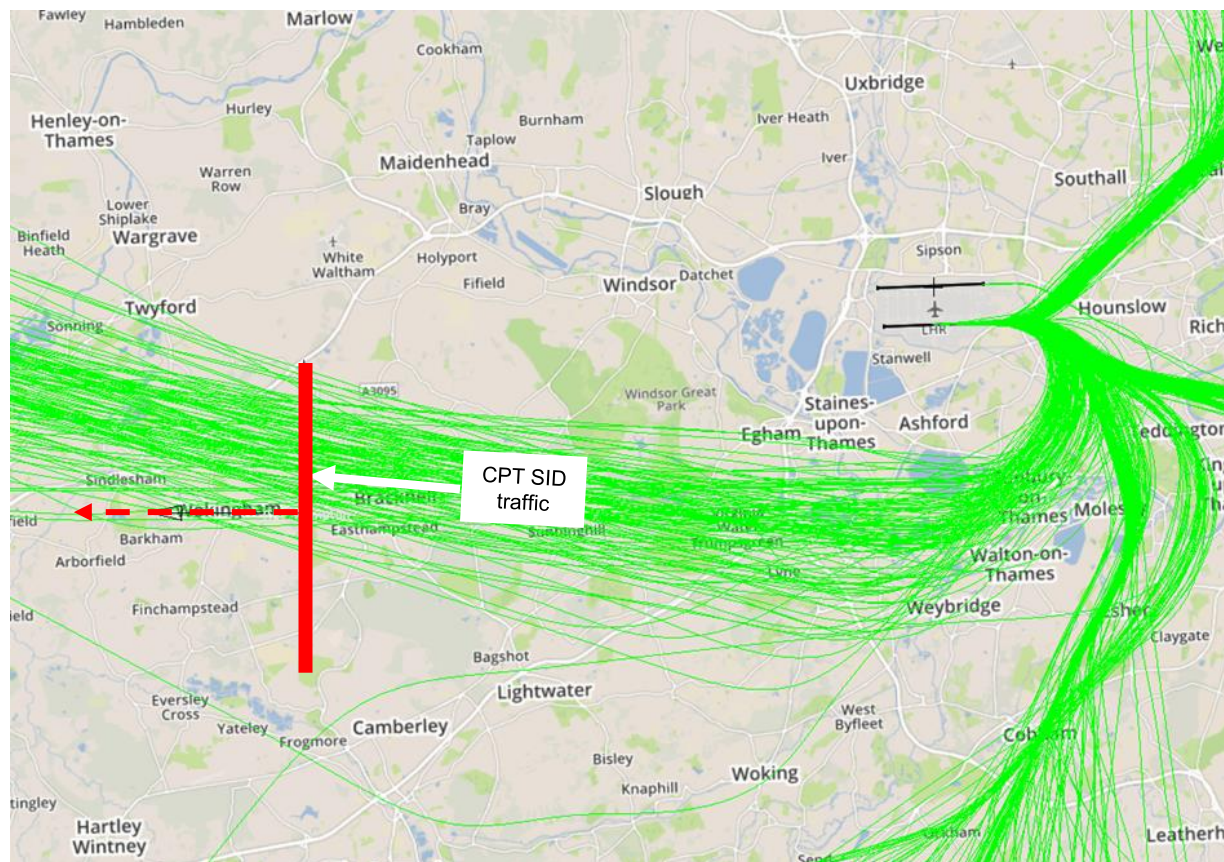
The Bracknell and Wokingham gate runs approximately north-south and is approximately 11km long, centred just to the east of Wokingham & west of Bracknell

Bracknell and Wokingham gate location and extent



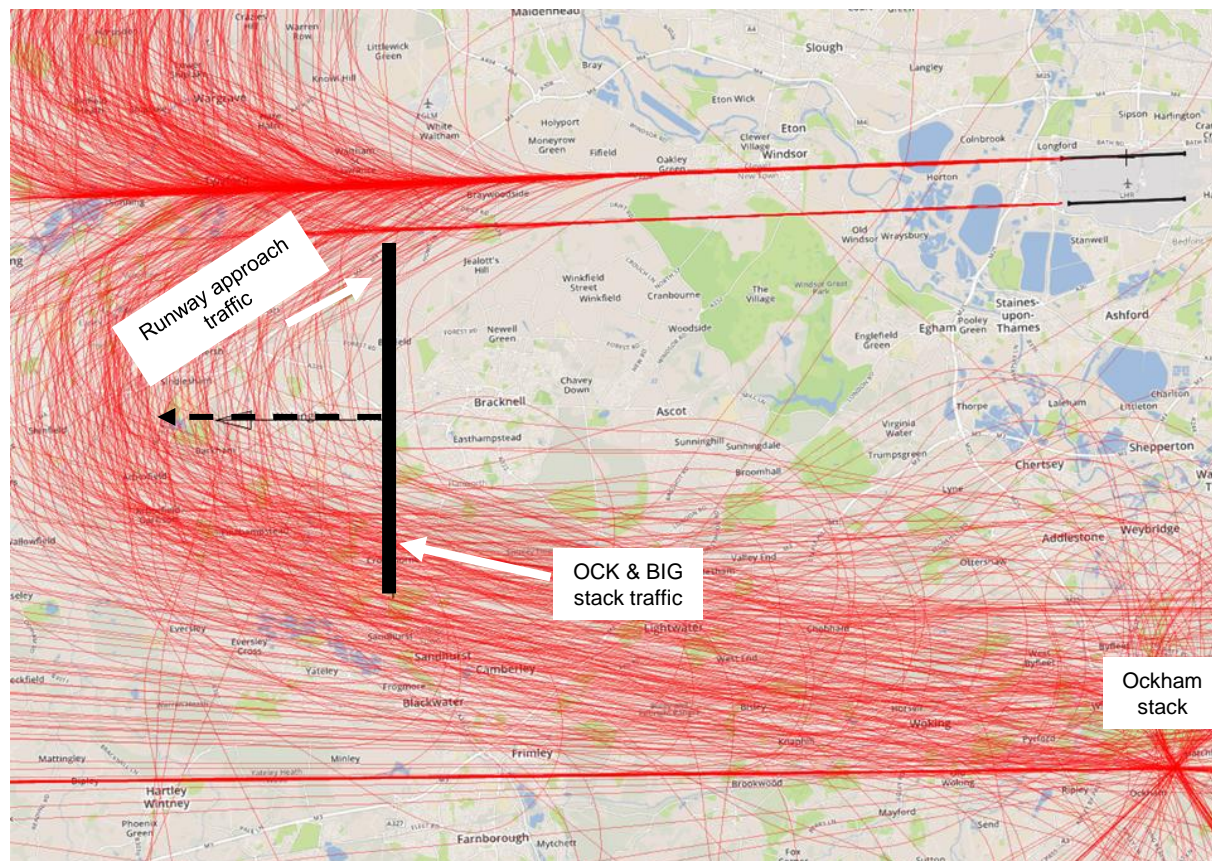
On easterly departure operations, the gate is crossed by CPT SID traffic travelling west

Example of easterly departure traffic crossing the Bracknell and Wokingham gate



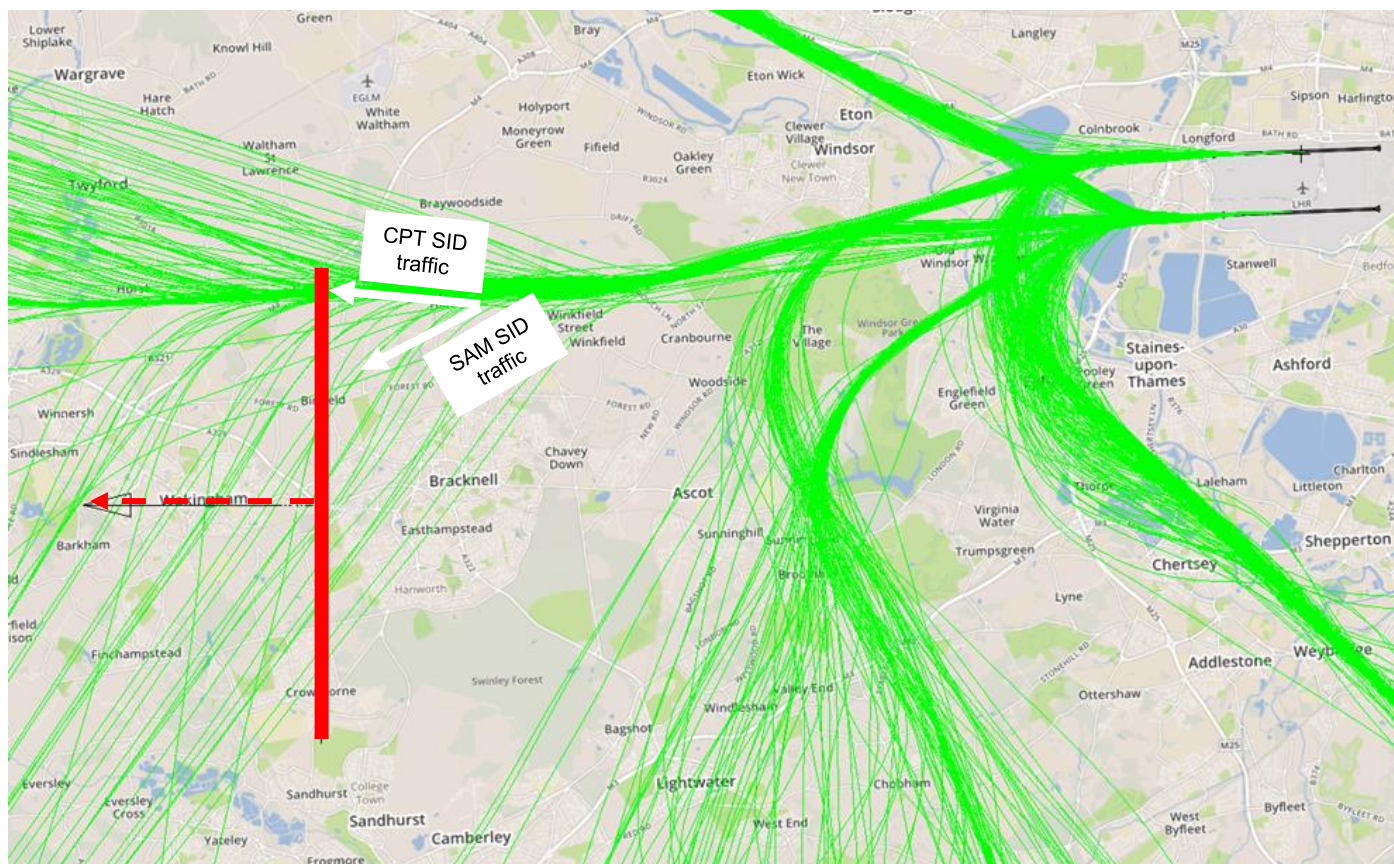
On easterly arrival operations, the gate is crossed by OCK and BIG stack traffic travelling west, and runway approach traffic travelling east

Example of easterly arrival traffic crossing the Bracknell and Wokingham gate



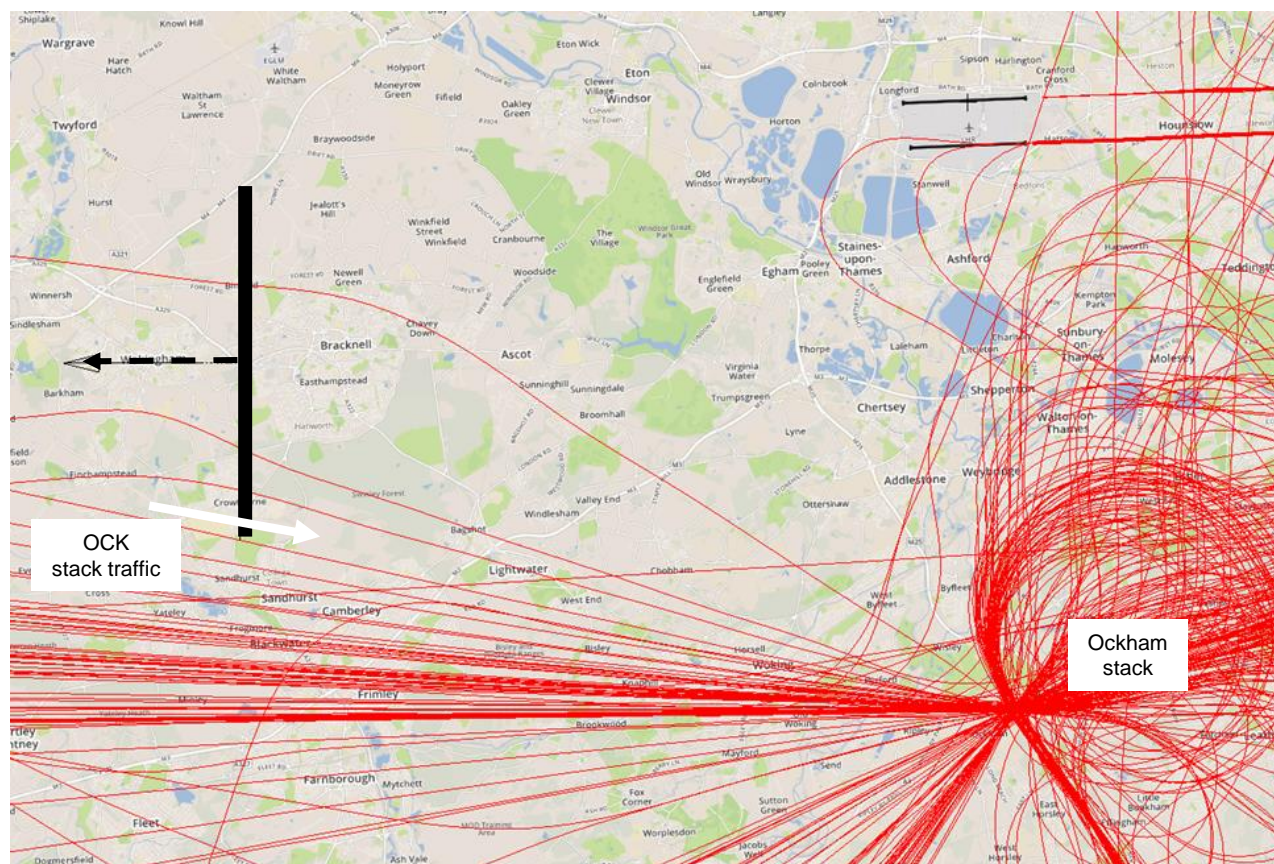
On westerly departure operations, the gate is crossed by CPT and SAM SID traffic travelling west

Example of westerly departure traffic crossing the Bracknell and Wokingham gate



Westerly arrival traffic crosses the gate, travelling east to enter the OCK stack

Example of westerly arrival traffic crossing the Bracknell and Wokingham gate



The analysis has investigated different characteristics of the traffic traversing the gate from the start of 2011 to February 2016

- The proportion of days per year when the gate has westerly, easterly and mixed operations
- Traffic volume (number of flights) crossing the gate:
 - for each day
 - the average daily traffic for each year
 - the average distribution of traffic across the day in half-hour intervals by aircraft type
- The lateral and vertical distributions of the traffic crossing the gate for each year, including:
 - The lateral and vertical centres of gravity (average positions) of the traffic swaths
 - The minimum height at which the lowest aircraft crosses the gate each day
 - The number of flights crossing the gate below 1500 feet and between 2000 feet and 2500 feet per day
 - Gate penetration (scatter) plots showing the lateral and vertical position that each flight crosses the gate for each of the years analysed
- Heat maps showing the concentration or density of the traffic crossing the gate
- The aircraft fleet mix:
 - the relative proportions of A380, heavy and medium sized aircraft crossing the gate for each year analysed
 - gate penetration (scatter) plots for A380, heavy and medium sized aircraft showing the lateral and vertical position that each flight crosses the gate for each of the years analysed
- The mix of destinations – short-haul, medium-haul, long-haul and ultra long-haul – for the traffic crossing the gate for each year

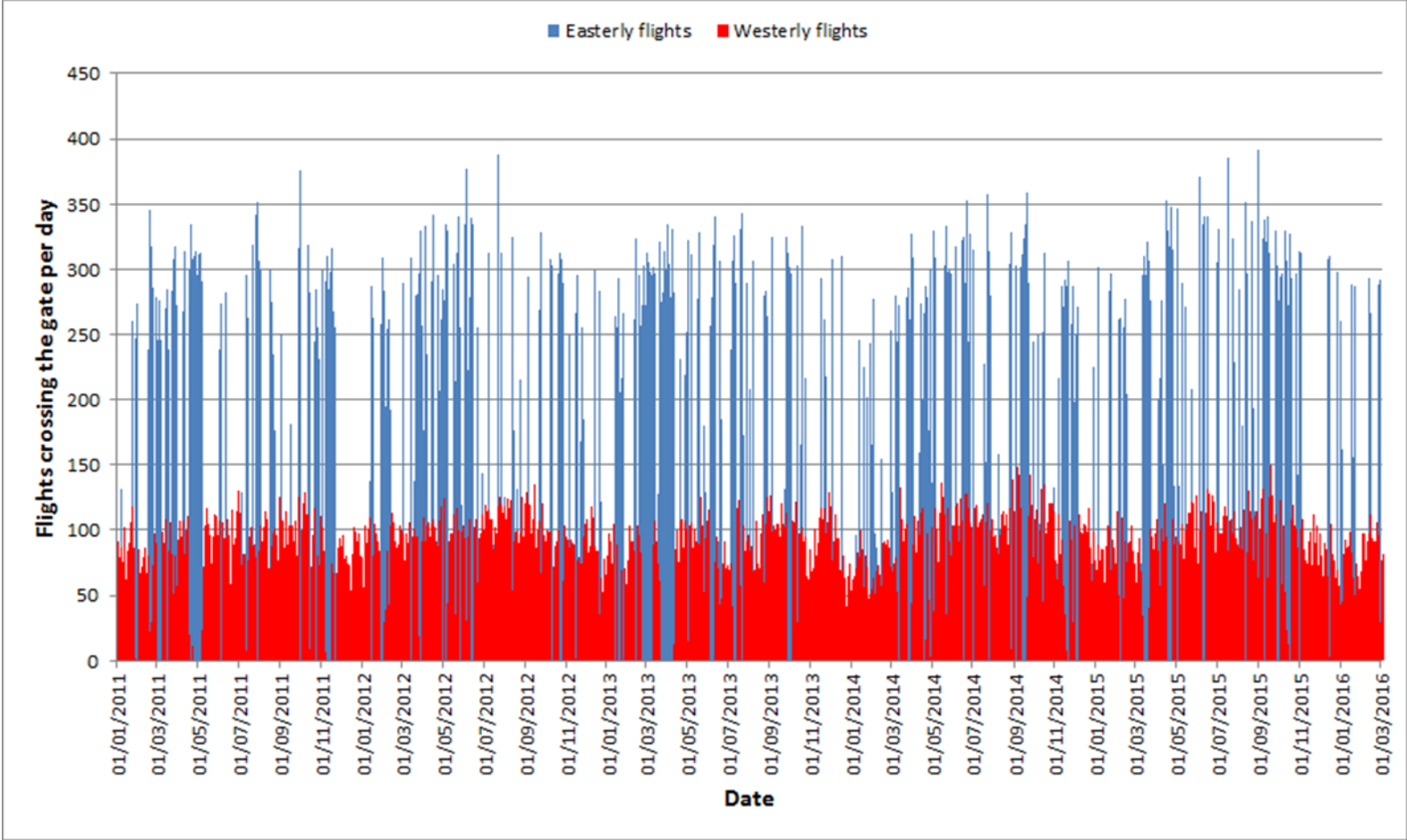


EVOLUTION OF TRAFFIC FROM 2011 TO 2016

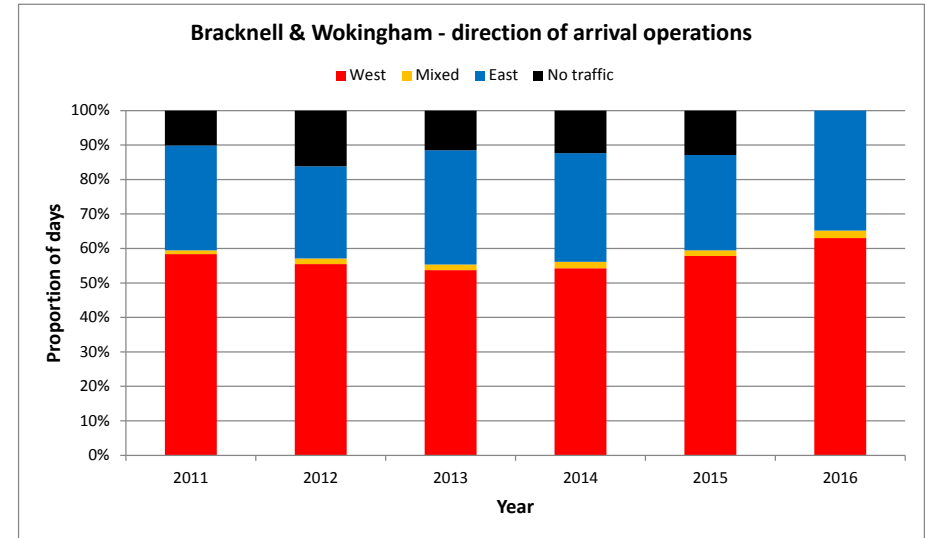
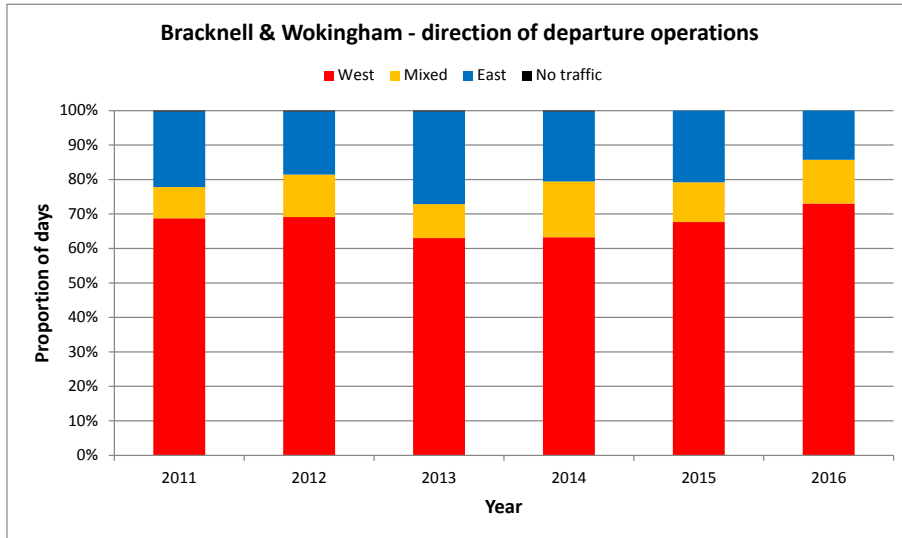
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Approximately three times more flights cross the gate on easterly days than westerly days, dominated by easterly arrivals

Daily traffic volume crossing the Bracknell and Wokingham gate from 1 January 2011 to 1 March 2016



The gate operates on westerlies for between 60% and 70% of days for departures and between 50% and 60% of days for arrivals



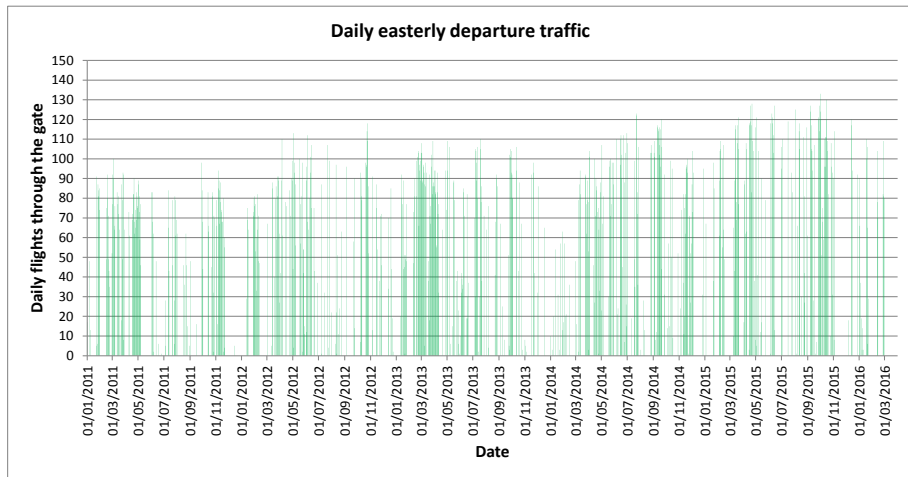
Westerly operations are defined as days when the airport operates solely in the westerly direction; similarly easterly operations are defined as days when the airport operates solely in an easterly direction. Mixed operations are defined as days when there are operations in both directions. No traffic is defined as days when no aircraft cross the gate

The reason for the difference in the west:east mix is likely due to a combination of:

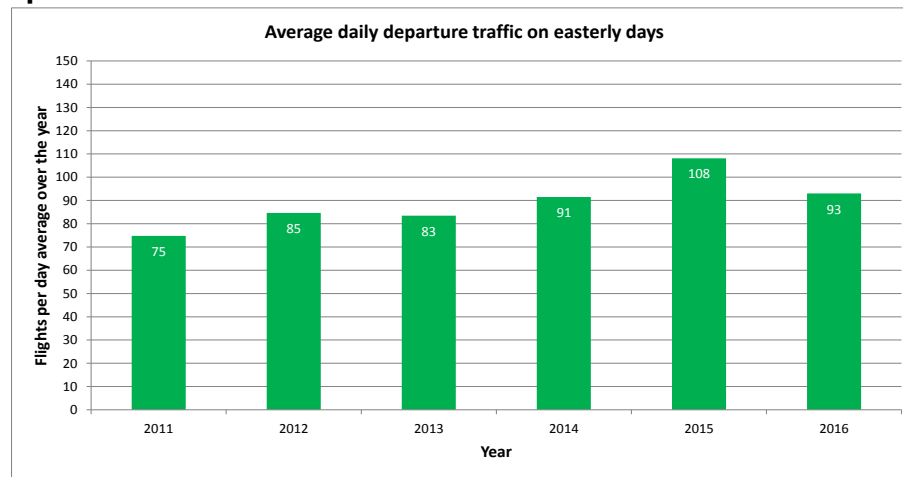
- early morning arrivals, following a different alternation pattern to daytime traffic and sometimes have an easterly preference that switches to westerly preference at 06:00 hours. When this switch happens, traffic can arrive on the easterly runways in the early morning and switch to the westerly runways at 06:00
- the higher proportion of no traffic days for (westerly) arrivals than departures, when no arrivals traffic crosses the gate

The daily volume of easterly departure traffic has increased from 2011 to 2015 and is higher in summer than in winter

Volume of easterly departure traffic



There is a cyclical pattern on the easterly daily departure traffic volume with higher levels in summer than in winter. This is superimposed on a general increase from 2011 to 2015. As only winter data is available for 2016, the cyclical pattern is currently at the bottom of the oscillation so does not imply a trend to a decrease in traffic volume.



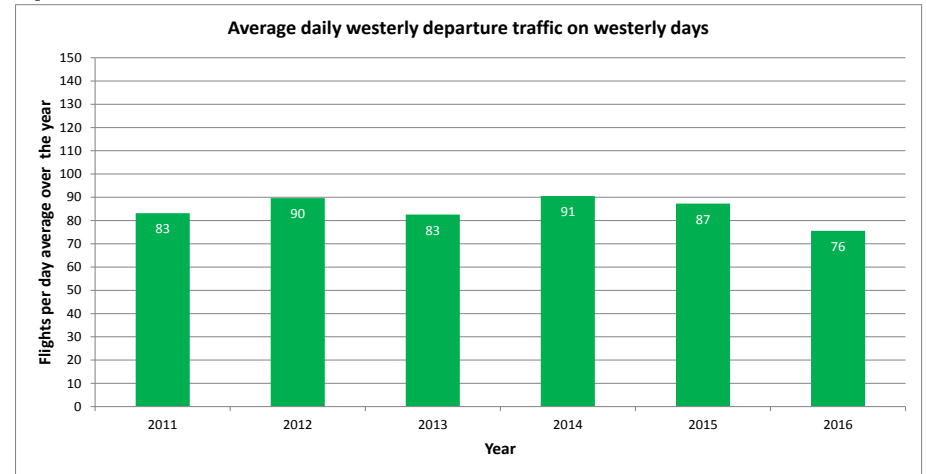
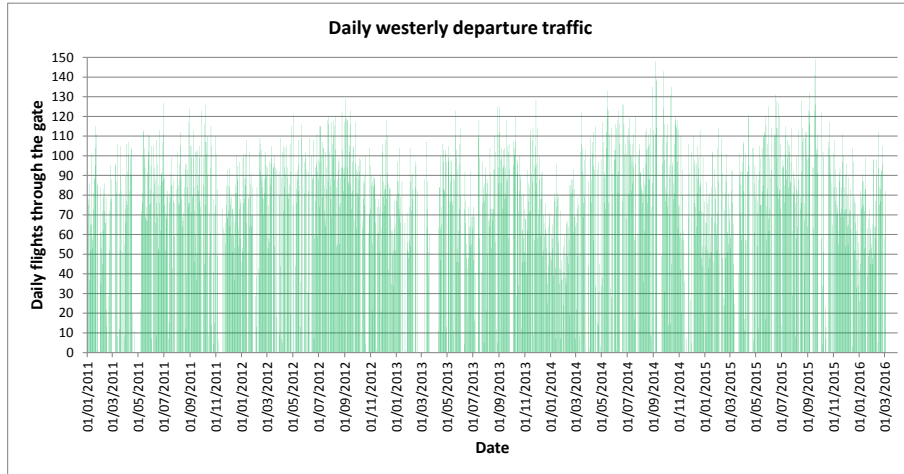
The average daily departure traffic through the gate on easterly days has increased from 75 flights per easterly day in 2011 to 108 flights per day in 2015.

During the first two months of 2016, the average volume was 93 flights per easterly day.

Note: easterly daily averages are derived from days when the airport is operating in the easterly direction only, e.g. the annual daily average is the total easterly traffic crossing the gate per year divided by the number of easterly days for that year

The volume of westerly departure traffic does not show any underlying trend but is higher in summer than in winter

Volume of westerly departure traffic



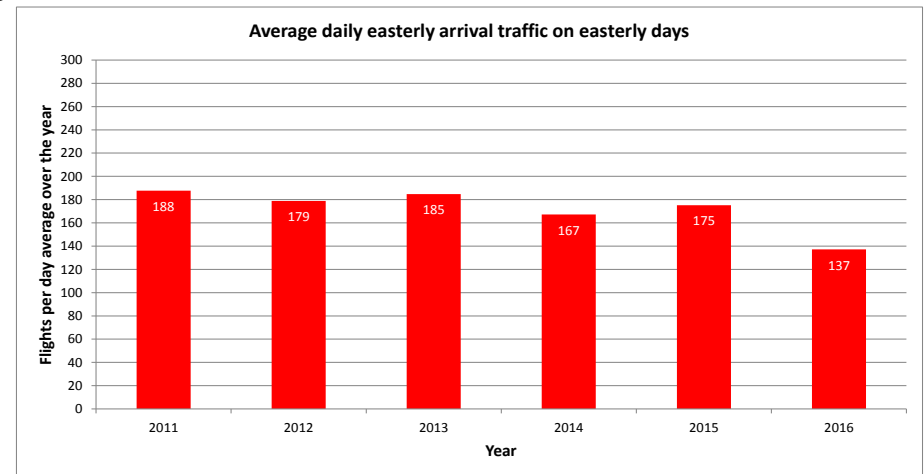
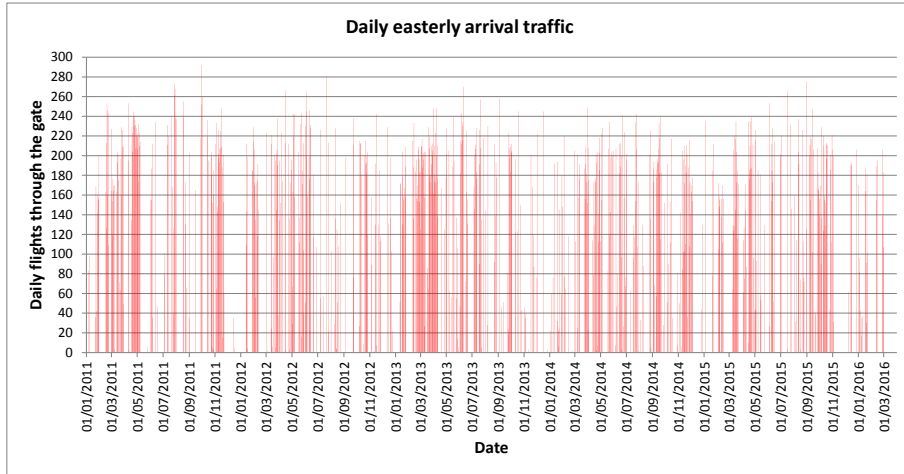
Daily westerly departure traffic is cyclical, having higher volume in the summer season than the winter season but without any underlying trend

The average daily westerly departure traffic through the gate on westerly days was approximately 83 flights per westerly day in 2011 and was 87 flights per westerly day in 2015. The average so far for 2016 is 76 westerly departures per westerly day noting that this is winter and volumes are typically lower in winter than summer

Note: westerly daily averages are derived from days when the airport is operating in the westerly direction only, e.g. the annual daily average is the total westerly traffic crossing the gate per year divided by the number of westerly days for that year

The daily volume of easterly arrival traffic crossing the gate appears to be showing a general downward trend

Volume of easterly arrival traffic



The daily arrivals traffic crossing the gate on easterly days shows an underlying decreasing trend (see right hand chart for annual averages). However, there is considerable day-to-day variation above and below the average. There is also a wave pattern modulating the underlying increase that appears to follow the cyclical summer:winter pattern

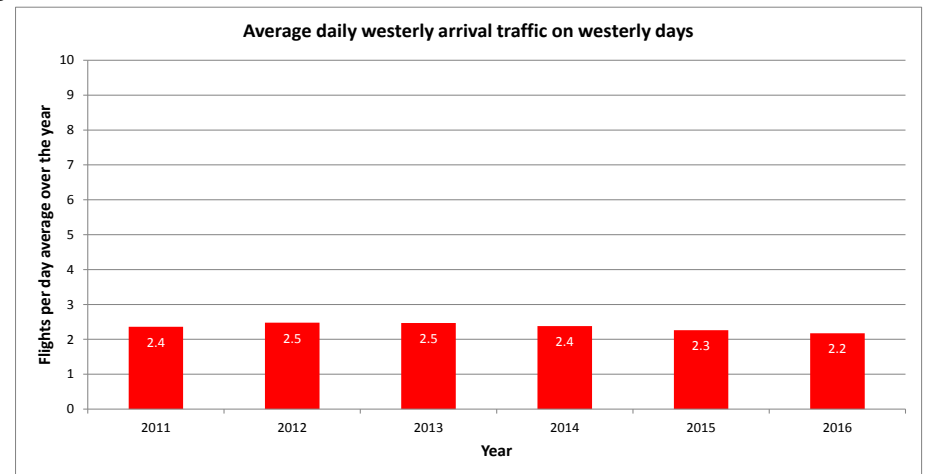
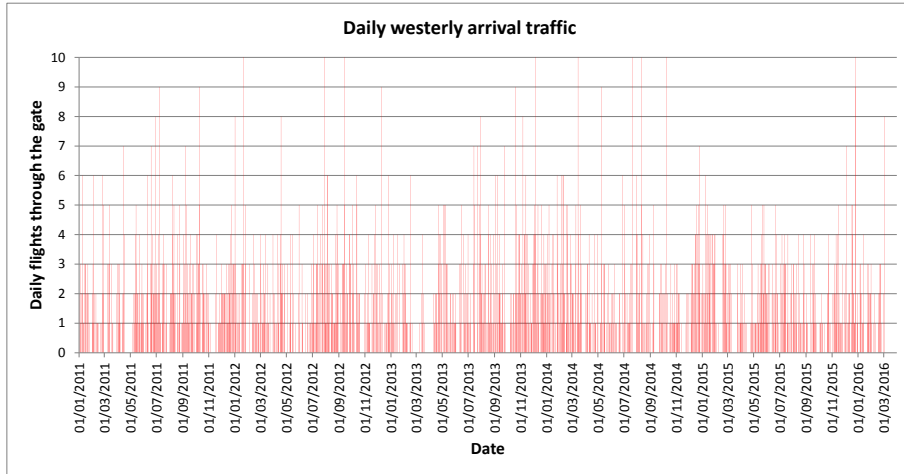
The average easterly arrival traffic through the gate has decreased from 2011 at 188 flights per easterly day to 175 flights per easterly day in 2015.

The lower figure of 137 flights per easterly day observed for the first two months in 2016 only covers the two lowest volume winter months so it not necessarily representative of the whole year

Note: easterly daily averages are derived from days when the airport is operating in the easterly direction only, e.g. the annual daily average is the total easterly traffic crossing the gate per year divided by the number of easterly days for that year

The volume of westerly arrivals traffic is low, averaging around two flights per westerly day

Volume of westerly arrival traffic



Daily westerly traffic crosses at the extreme southern end of the gate and is typically around two flights per day but with a high proportion of days with four to six flights per day and the occasional day with up to ten flights

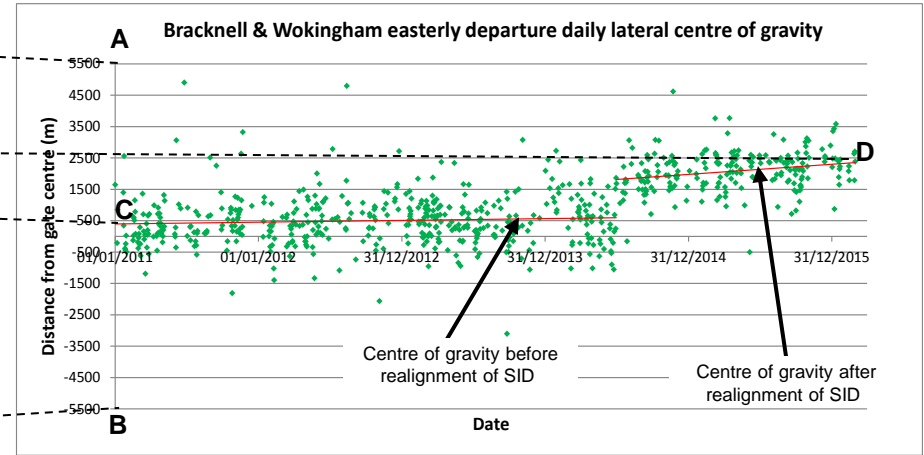
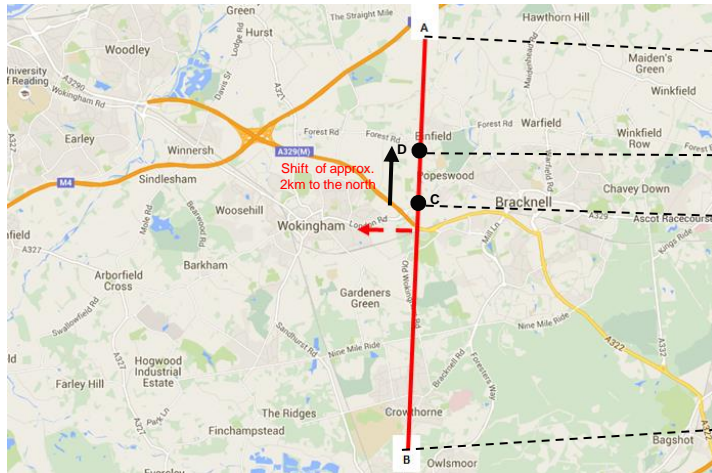
The average daily arrival traffic through the gate on westerly days has remained more or less constant from 2011 to 2016 at approximately 2.5 westerly arrivals per westerly day

Because of the low volume of westerly arrivals crossing the gate detailed analysis has not been performed

Note: westerly daily averages are derived from days when the airport is operating in the westerly direction only, e.g. the annual daily average is the total westerly traffic crossing the gate per year divided by the number of westerly days for that year

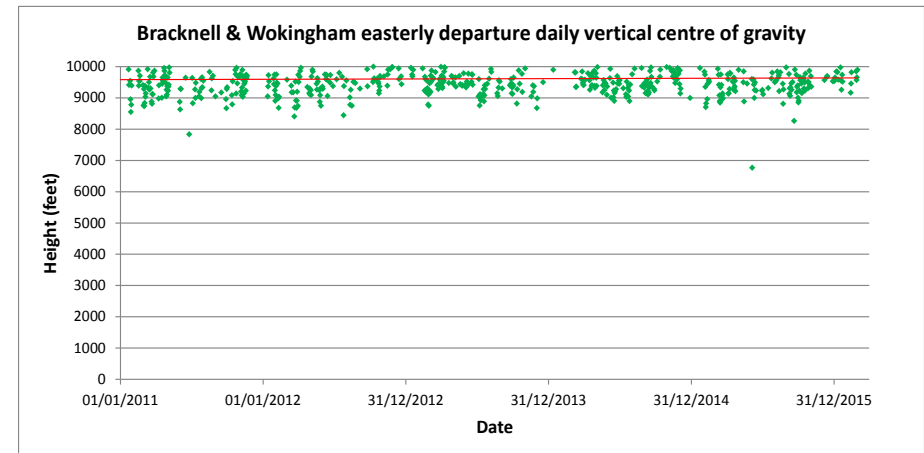
The lateral centre of gravity of the easterly departure swath has shifted by approximately 2km to the north due to realignment of the CPT SID

Approximate centre of gravity of easterly departures



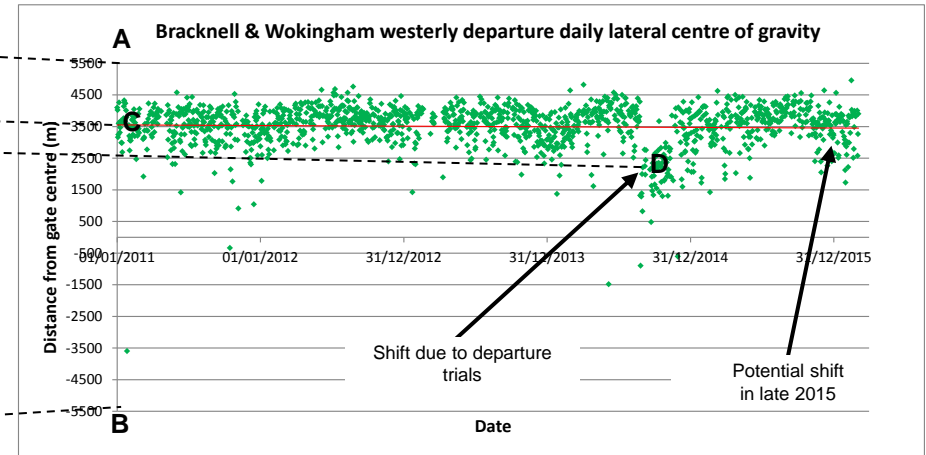
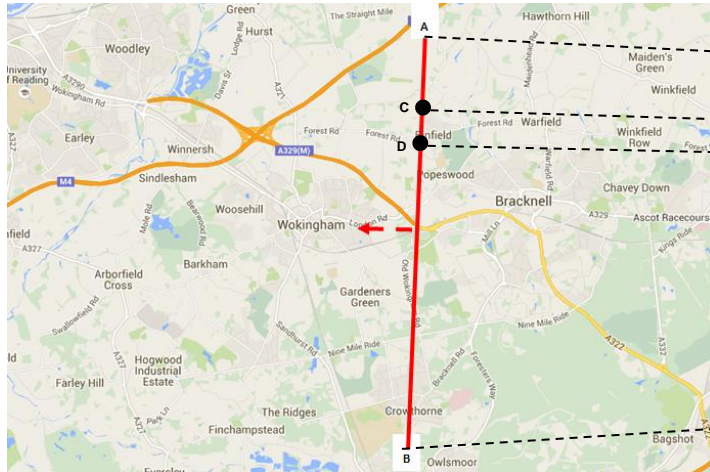
The average lateral centre of gravity (CoG) of the easterly departure traffic has shifted from point C, 500m to the right of gate centre, to point D, 2500m to the right of gate centre. This occurred mainly as a step change in mid-2014 due to realignment of the CPT SID

There is no trend on the height of the vertical CoG of the easterly departure traffic, which has remained consistent at approximately 9500 feet from 2011 to 2016, although there is day-to-day variation above and below this average



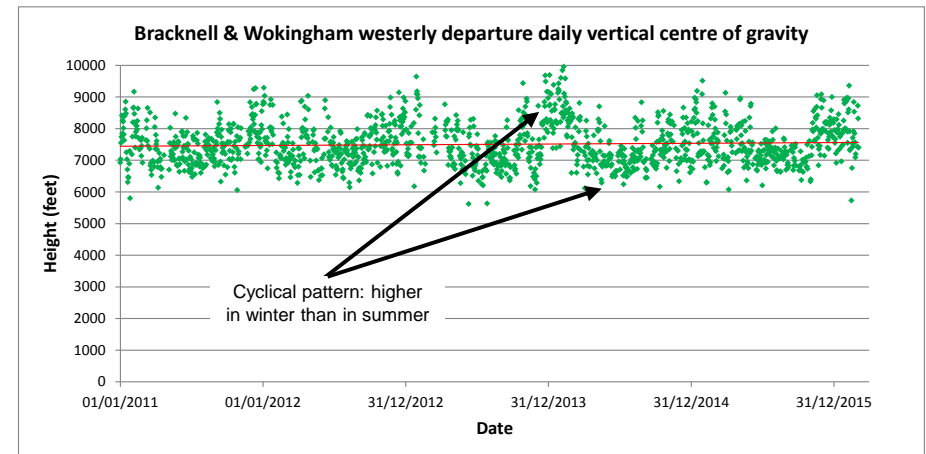
After returning to its pre-trial position after the departure trials, the lateral CoG of the westerly departure swath may be shifting south again

Approximate centre of gravity of westerly departures



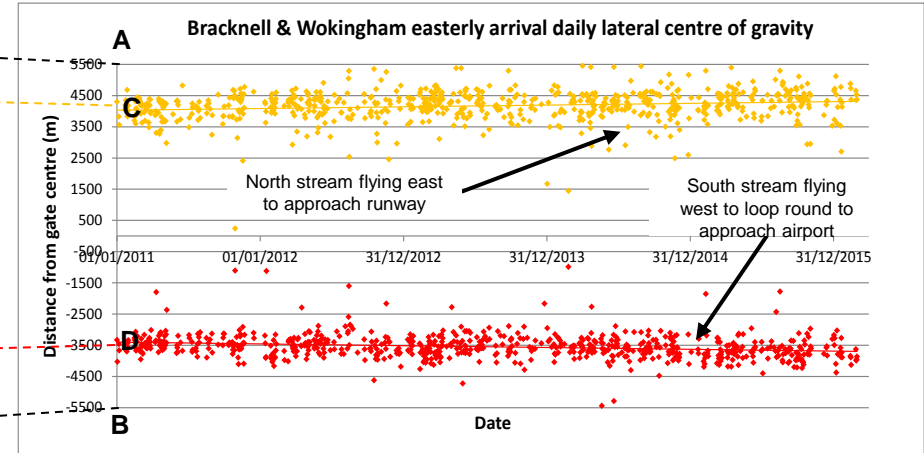
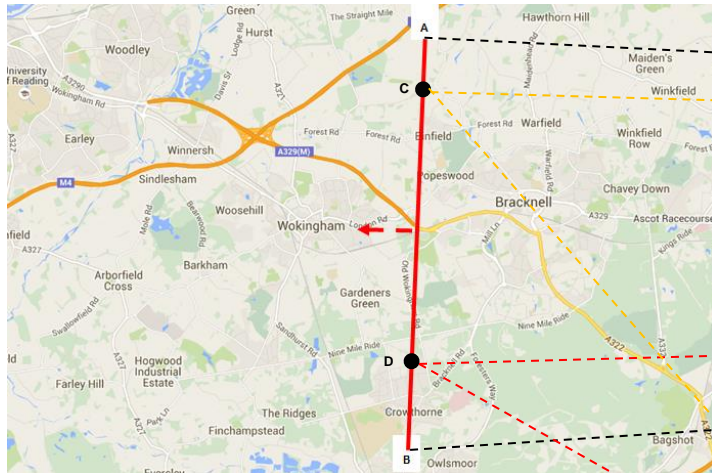
The average lateral centre of gravity (CoG) of the westerly departure traffic shifted from point C, 3500m to the right of gate centre, to point D, 2500m to the right of gate centre during the trials and returned afterwards. There appears to be a trend for the lateral CoG to shift to the south in late 2015

There is no trend on the height of the vertical CoG of the westerly departure traffic, which has remained consistent at approximately 7500 feet from 2011 to 2016. However, there is considerable day-to-day variation and a cyclical pattern with departures higher in winter than in summer



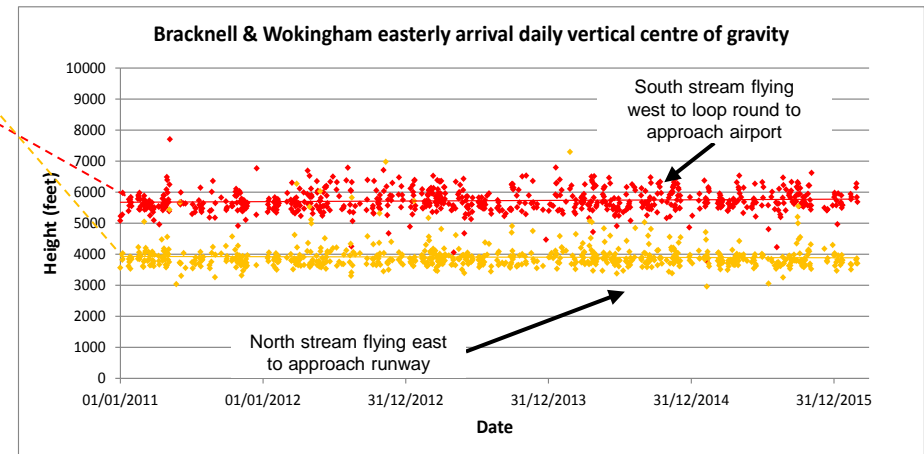
Easterly arrivals cross the gate in 2 streams: a northerly stream moving east to the runways and a southerly stream moving west to loop round to approach the airport

Approximate centre of gravity of easterly arrivals



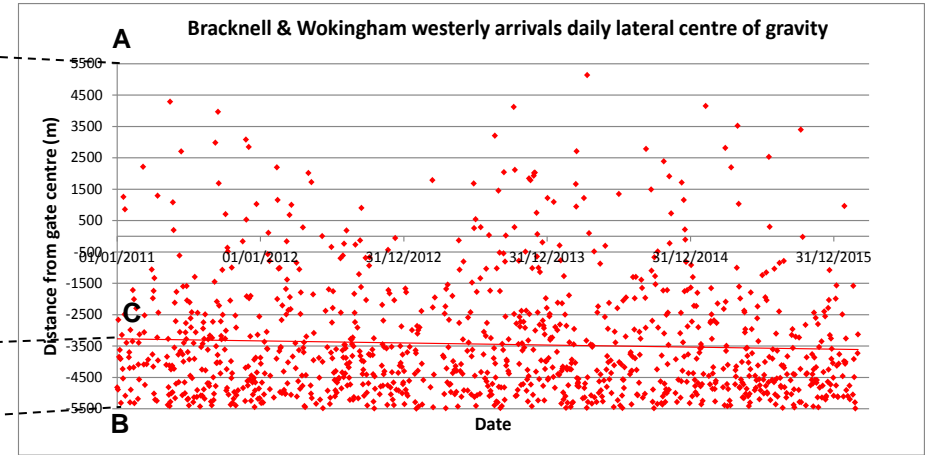
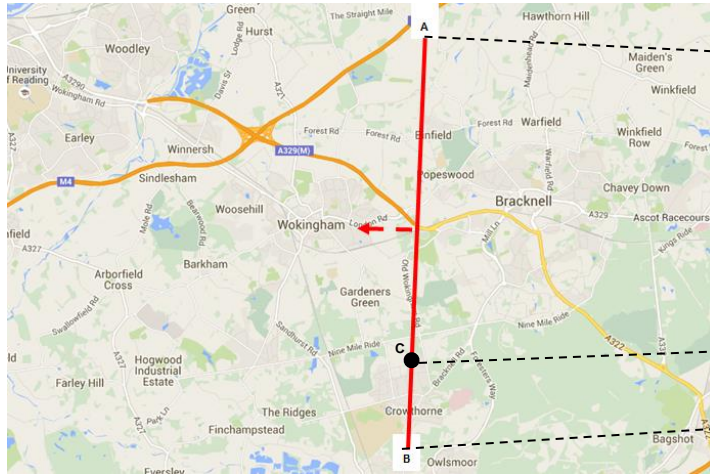
The average lateral centre of gravity (CoG) of the northerly easterly arrivals stream is approximately 4000m right of gate centre. The lateral CoG of the southerly stream is approximately 3500m to the left of gate centre. Both CoGs have remained consistent from 2011 to 2016

The average vertical CoG of the northerly easterly arrivals stream is at approximately 4000 feet. The vertical CoG of the southerly stream is approximately 5500 feet. Both vertical CoGs have remained consistent from 2011 to 2016 with no trend upwards or downwards



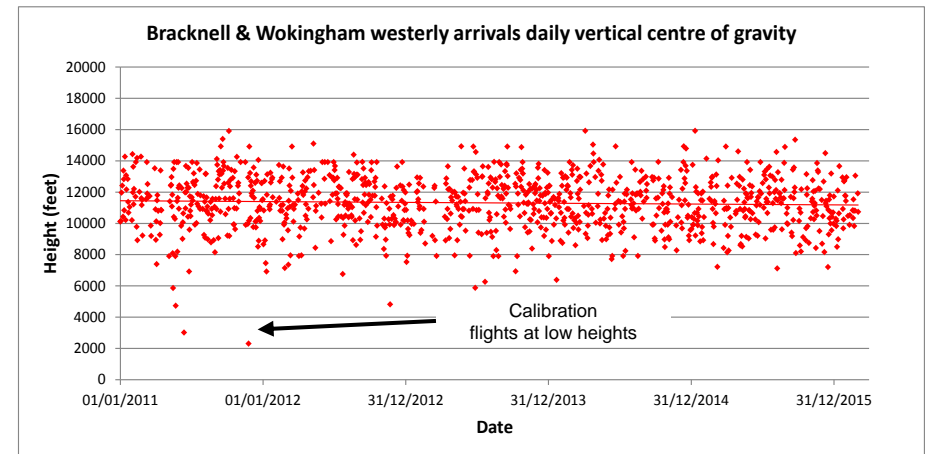
There is large scatter on the centres of gravity for the low volume of westerly arrivals

Approximate centre of gravity of westerly arrivals



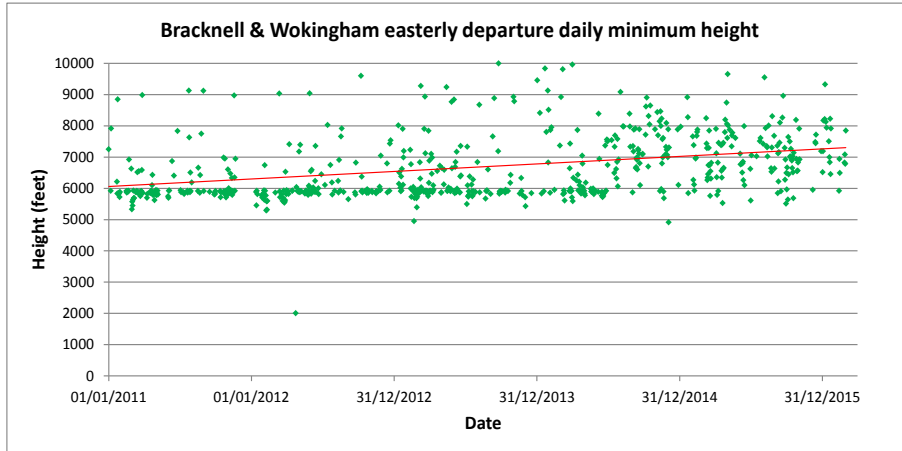
The average lateral centre of gravity (CoG) of the westerly arrival traffic is approximately 3500m to the left of gate centre although there is large scatter from day-to-day likely due to the small number of westerly arrival flights (on average 2.5 per day) crossing the gate

The vertical CoG for westerly arrival traffic is at approximately 11000 feet, again with large day-to-day scatter. Some very low flights are observed in 2011: these are technical flights used to calibrate the Airport's landing systems

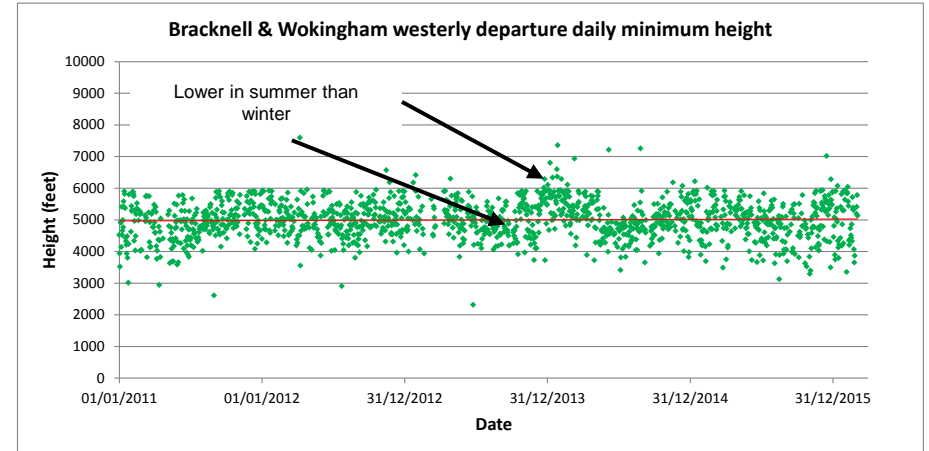


The trend on the minimum height for easterly departures is upwards whereas westerly departures show no trend in minimum height

Minimum height for departure traffic



The minimum height for easterly departures shows an upwards trend from 2011 to 2016 from 6000 feet to just over 7000 feet. Although the trend was upwards before the CPT SID was realigned, this change appears to have reduced the cluster of minimum heights at 6000 feet implying the air traffic control can now climb CPT SID departures more quickly than in the past

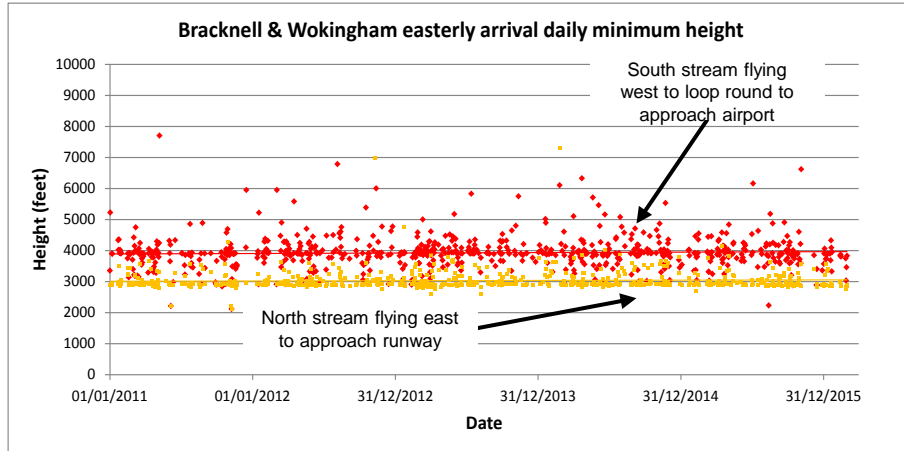


The minimum height for westerly departures is consistent at approximately 5000 feet but with day-to-day variations from 4000 feet to 6000 feet. There is evidence of a cyclical pattern: higher in winter than summer; particularly in 2013 and 2014

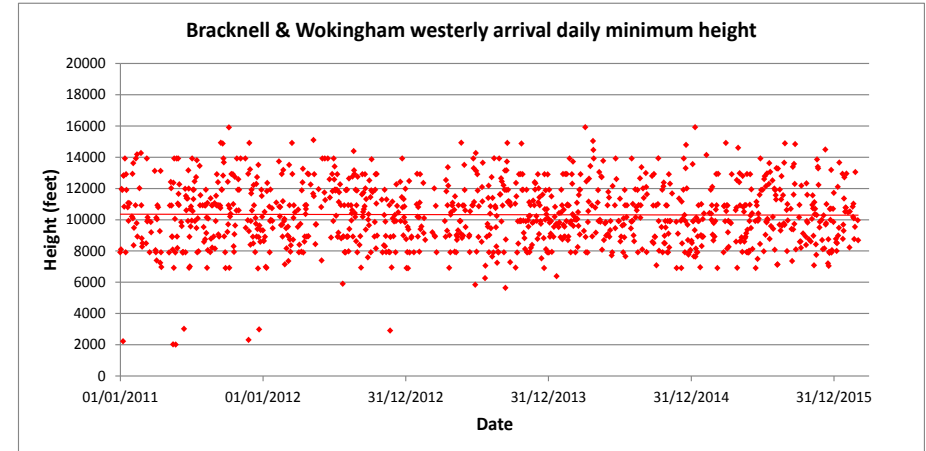
The flights at heights of order 2000 feet to 3000 feet are generally calibration flights

Neither easterly nor westerly arrivals show any trend in minimum daily height

Minimum height for arrival traffic



The average minimum height for the northerly easterly arrivals stream is very consistent at 3000 feet with little day-to-day variation. The average minimum height for the southerly arrivals stream is consistent at 4000 feet but with some day-to-day variation



The average daily minimum height for westerly arrivals is slightly above 10000 feet but with considerable day-to-day variation. The flights below 3000 feet are generally technical flights used to calibrate the airport's landing systems.

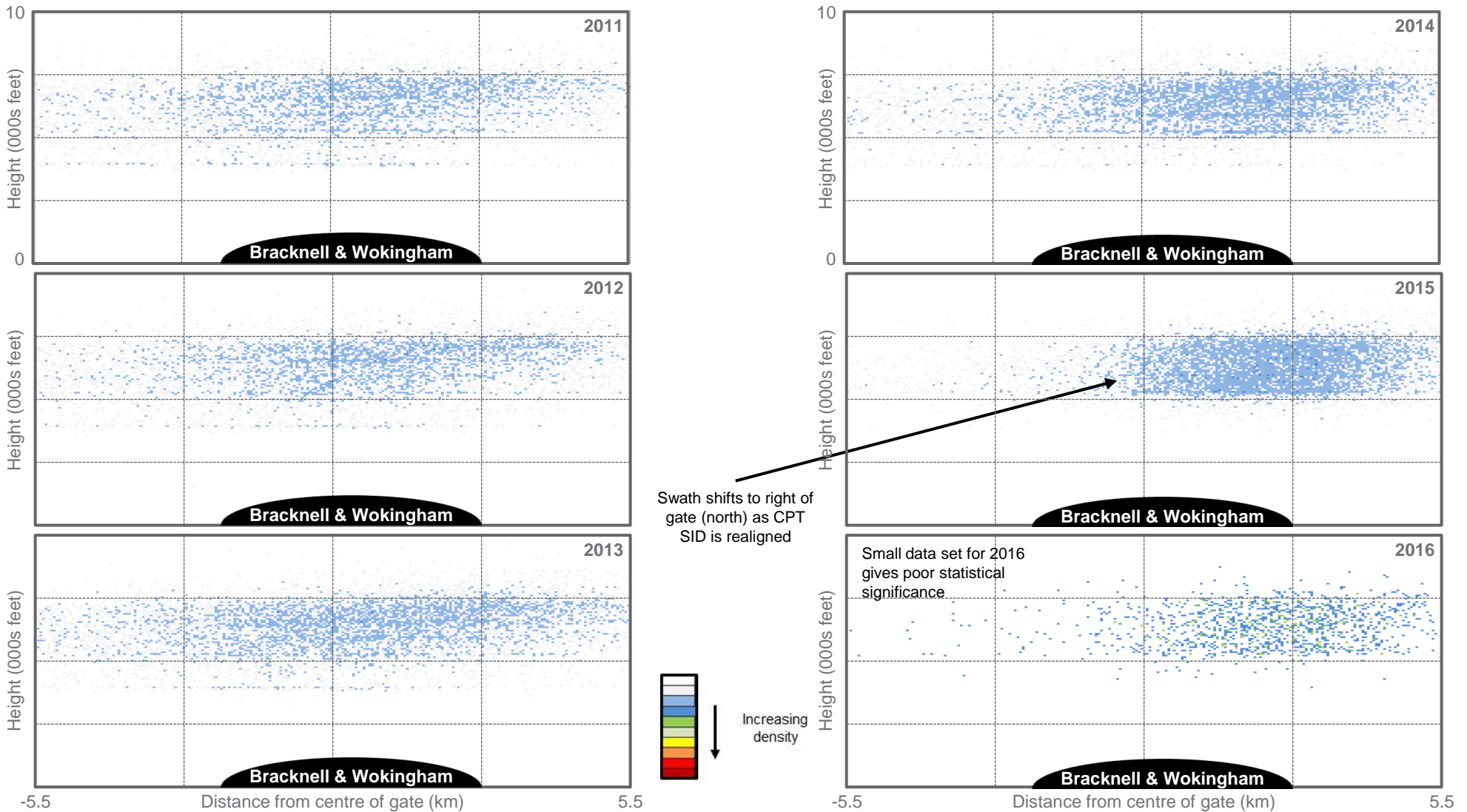
Note the difference in vertical scales for the easterly and westerly graphs



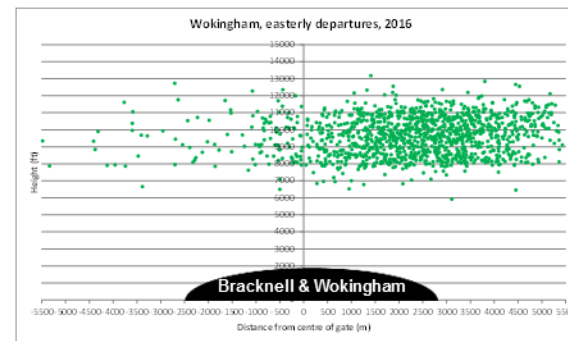
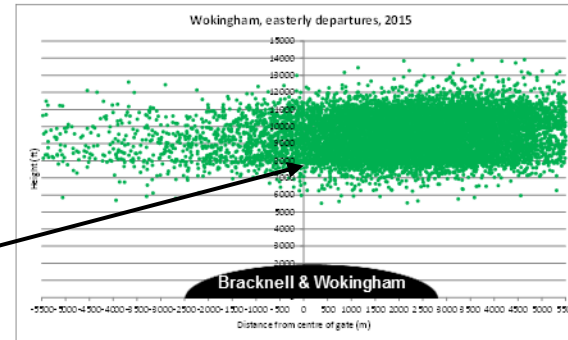
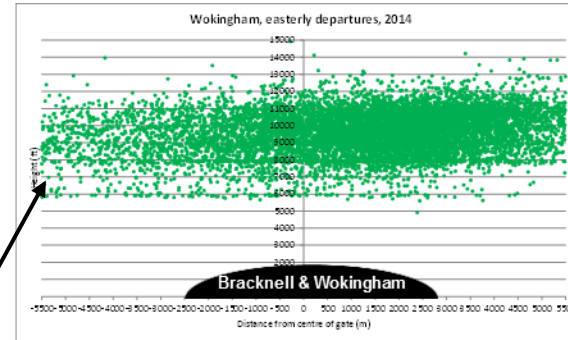
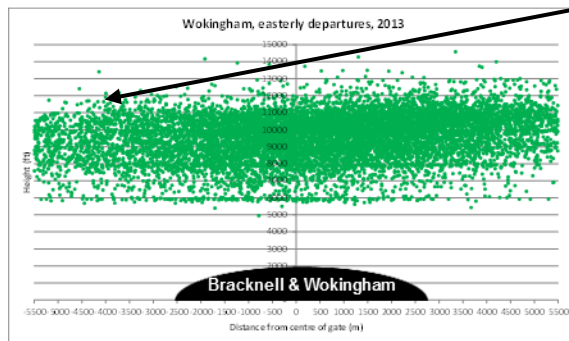
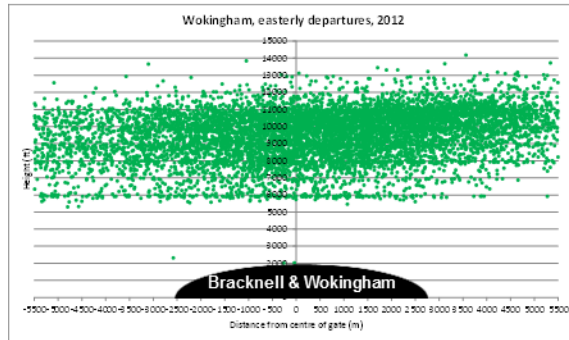
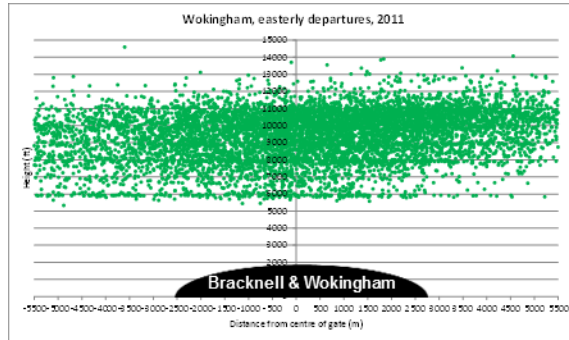
EASTERLY DEPARTURES

4

Easterly departure heat maps show the swath becoming more condensed and moving northwards when the CPT SID is realigned in mid-2014



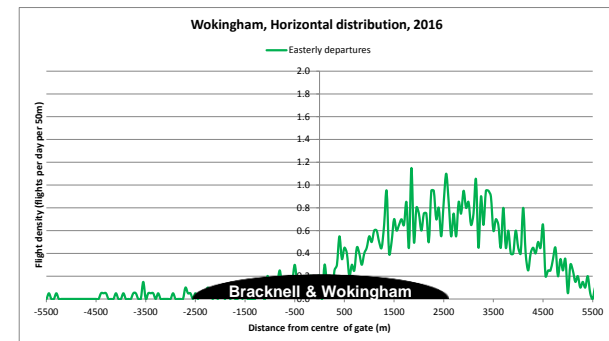
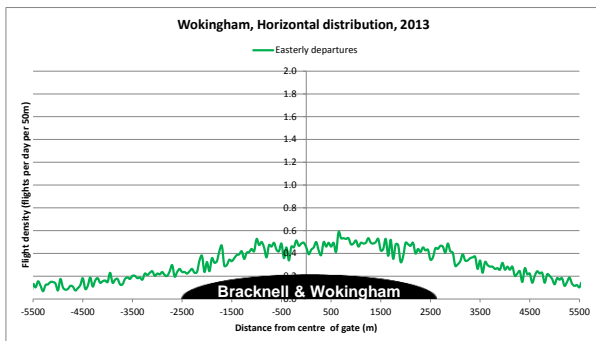
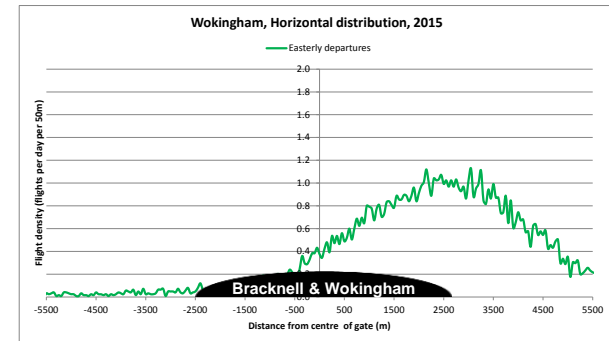
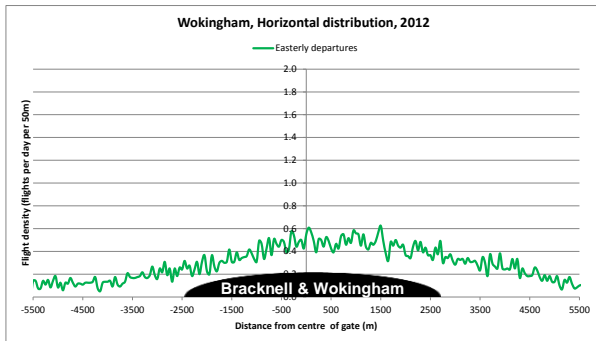
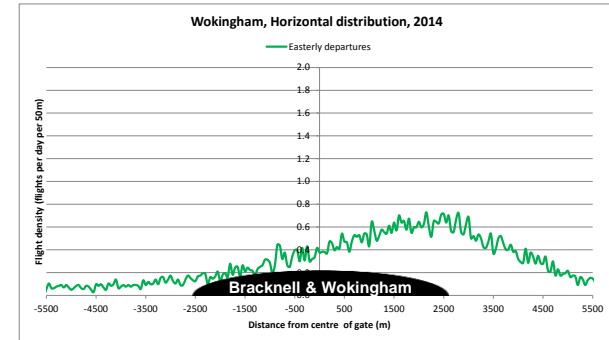
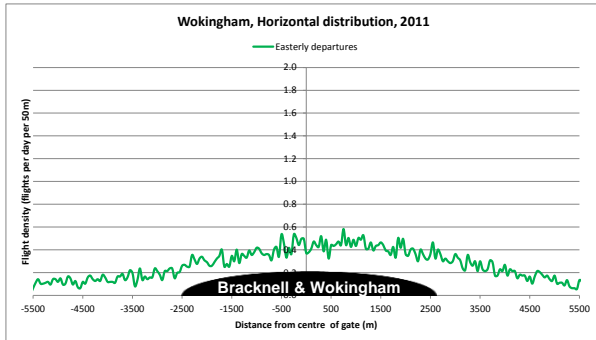
Scatter plots for easterly departures emphasise the shift in position of the CPT SID



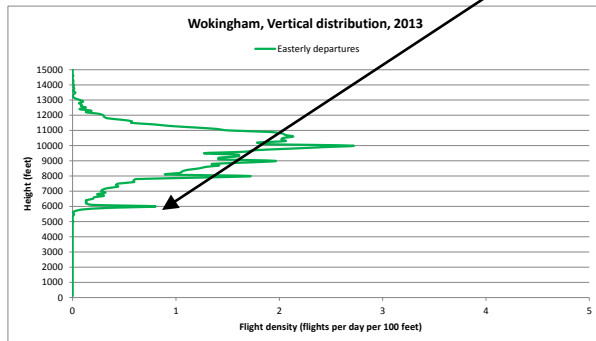
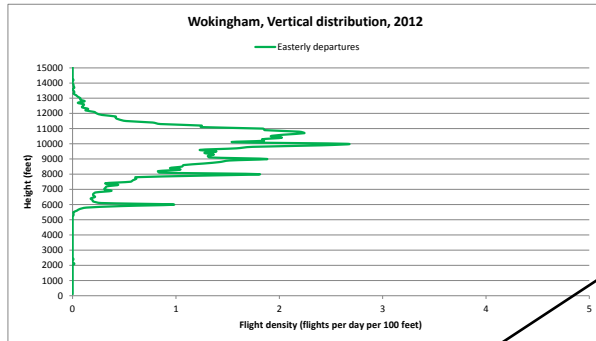
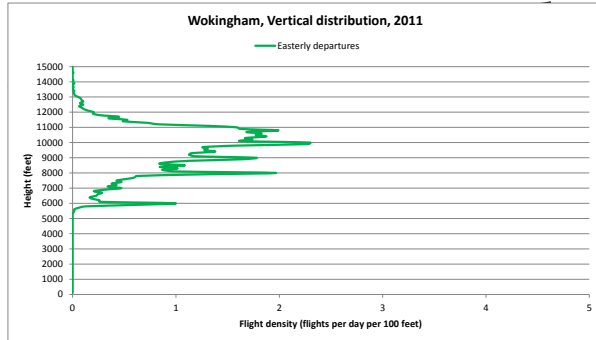
Swath shifts to right of gate (north) as CPT SID is realigned

There are far fewer flights recorded for 2016 than for other years because the sample only includes two months to the end of February 2016

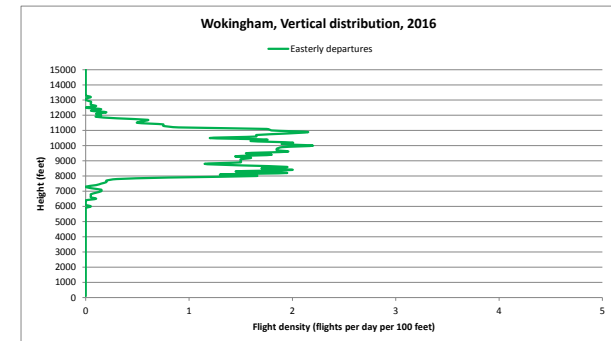
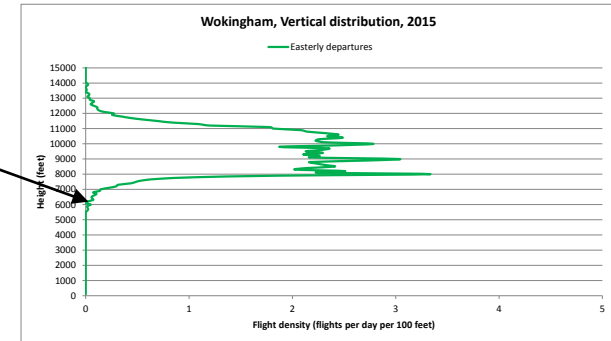
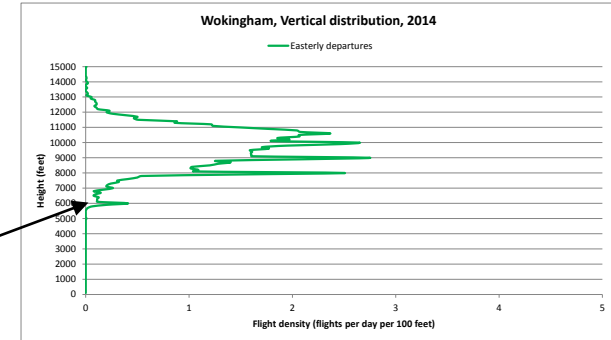
The horizontal traffic distributions illustrate the movement of the traffic swath and increased traffic to the north of the gate



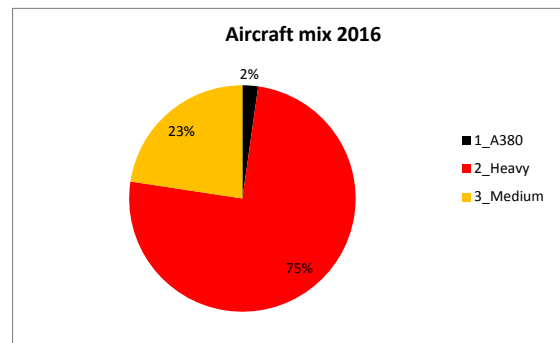
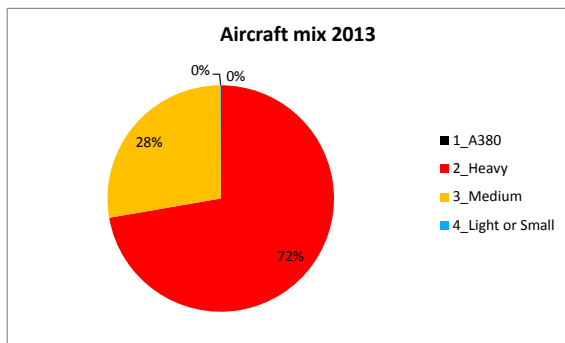
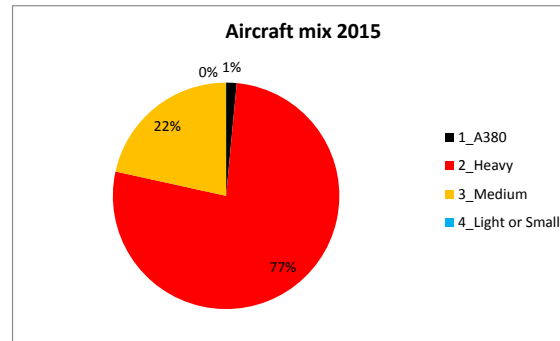
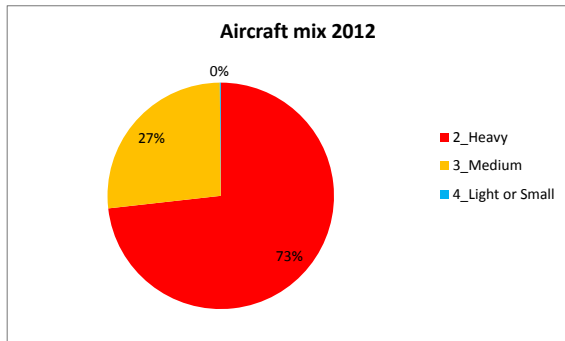
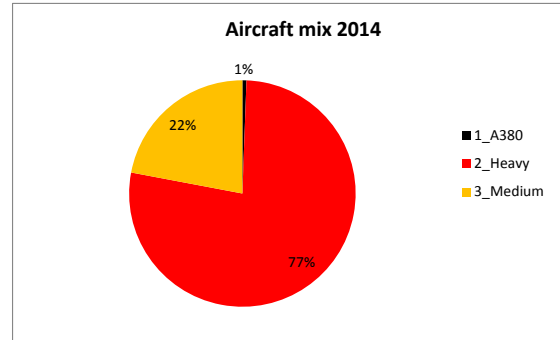
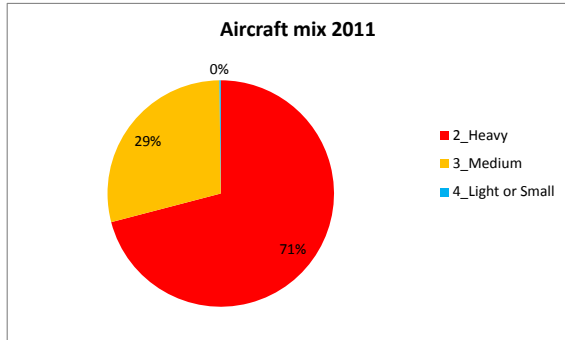
The peak in concentration at 6000 feet reduces and disappears coincident with the realignment of the CPT SID indicating a general increase in height at the gate



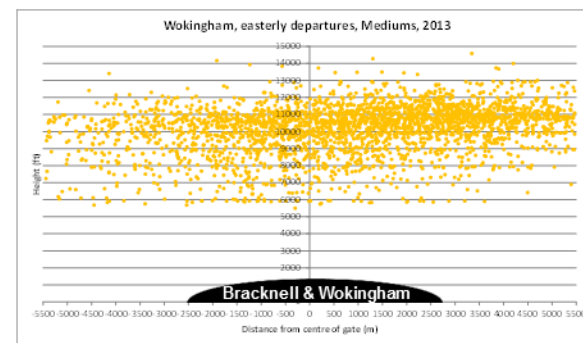
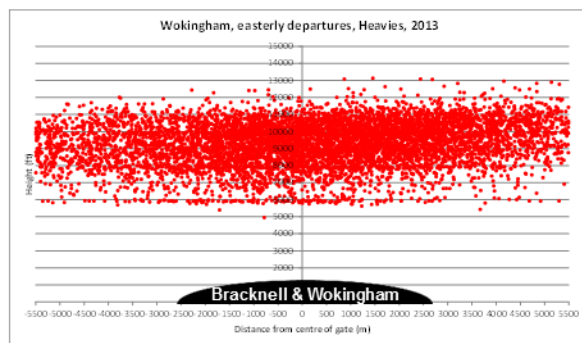
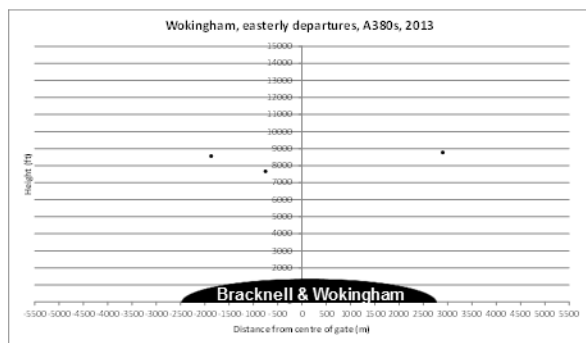
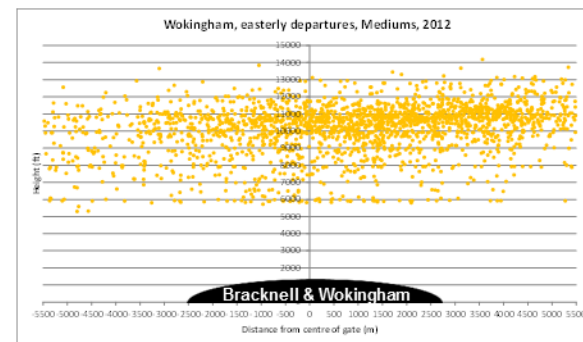
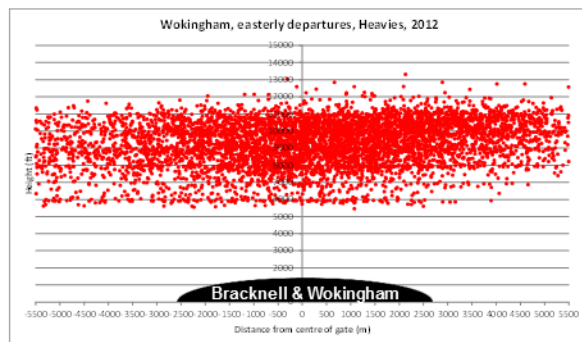
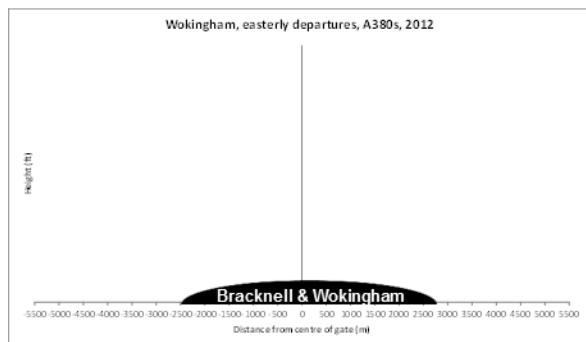
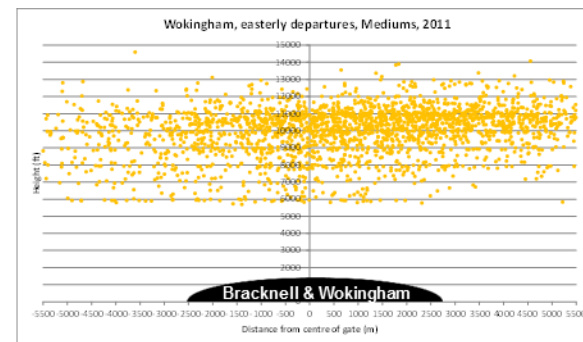
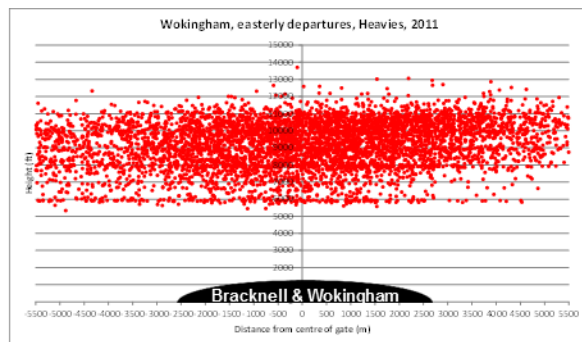
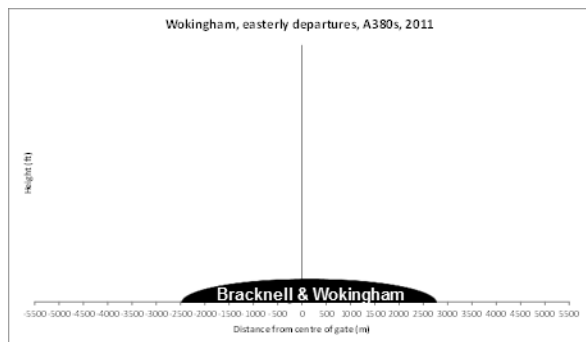
The peak in traffic density at 6000 feet reduces in 2014 and has disappeared by 2015



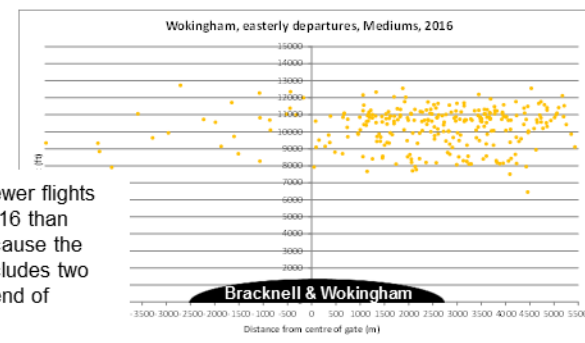
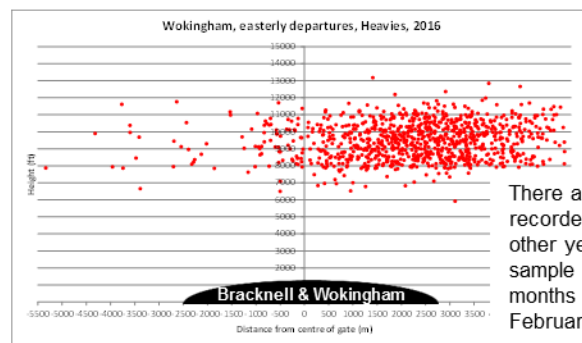
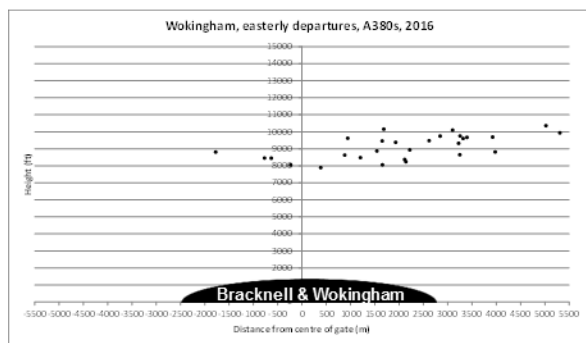
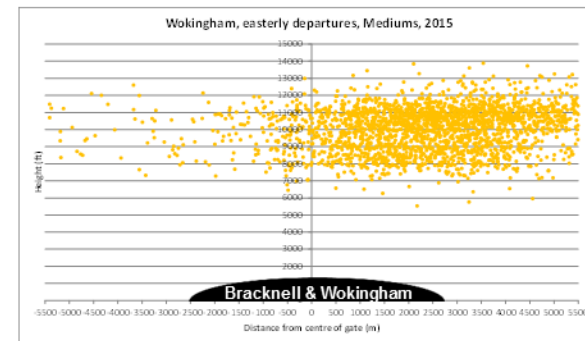
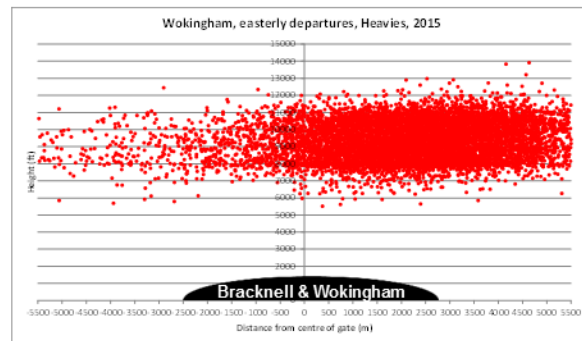
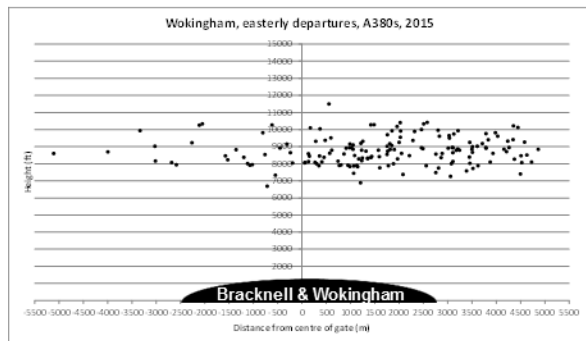
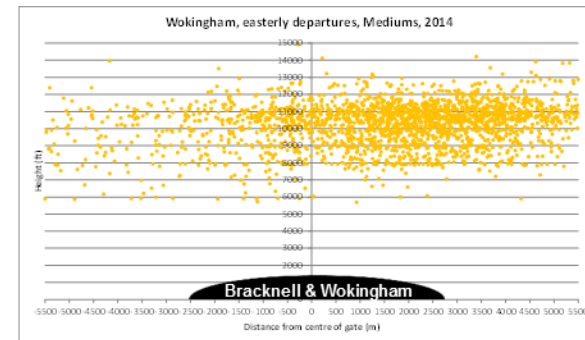
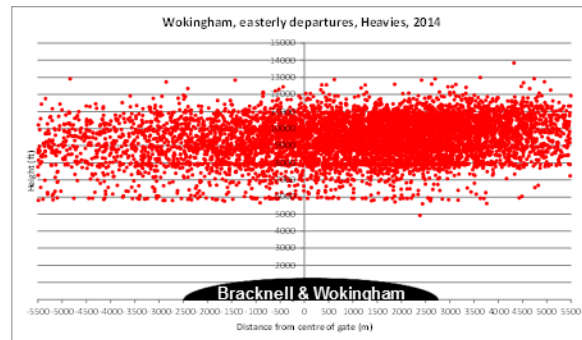
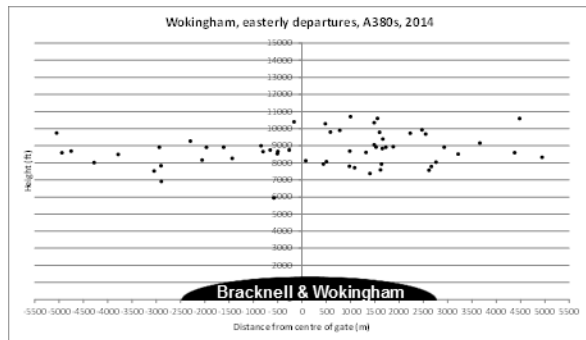
The proportion of large aircraft in the easterly departure mix increased from 71% in 2011 to 78% in 2015 and 77% in 2016: A380s currently make up 2% of the total



There does not appear to be any bunching by size of aircraft across the gate from 2011 to 2013

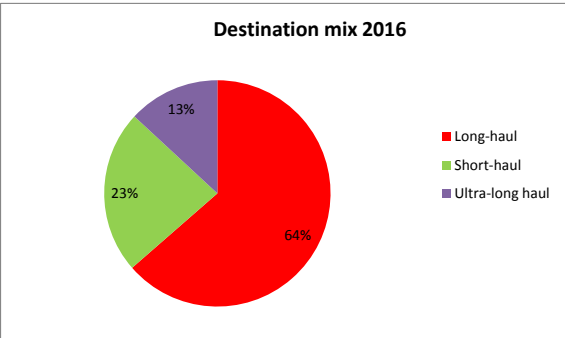
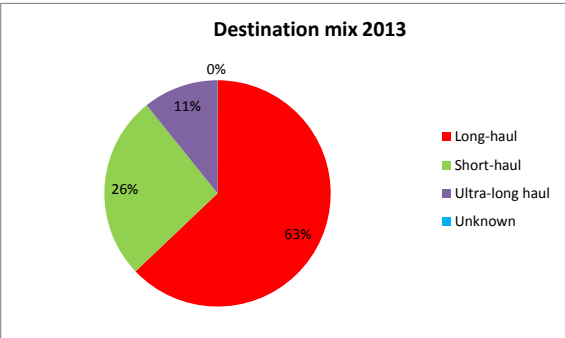
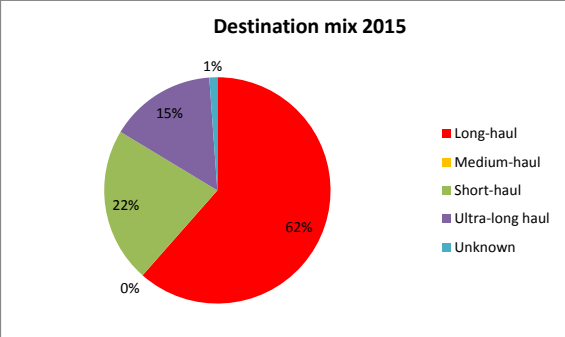
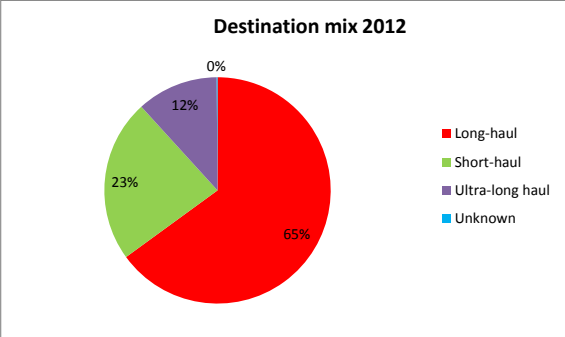
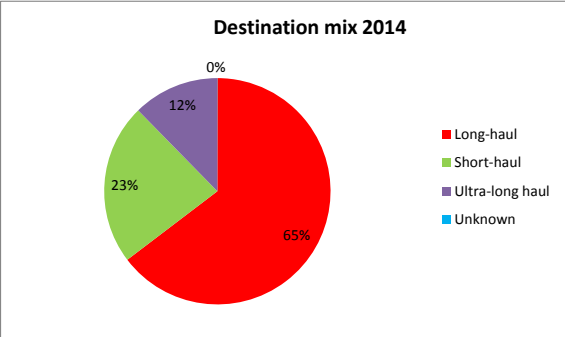
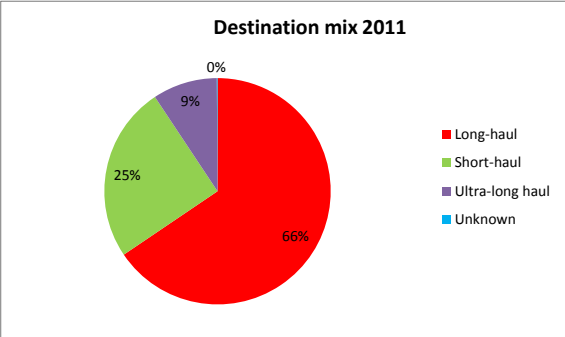


Scatter plots show the shift of all aircraft sizes northwards across the gate from 2014 and also highlight the increase in number of A380s in the mix



There are far fewer flights recorded for 2016 than other years because the sample only includes two months to the end of February 2016

The proportion of ultra long and long-haul destinations served by easterly departure traffic has remained consistent at approximately 77% of the total



Short-haul destinations typically have flight times shorter than three hours

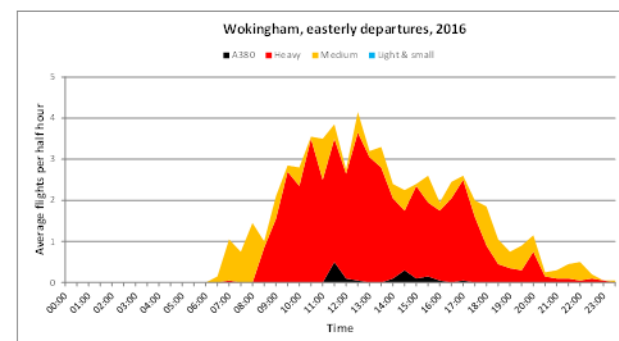
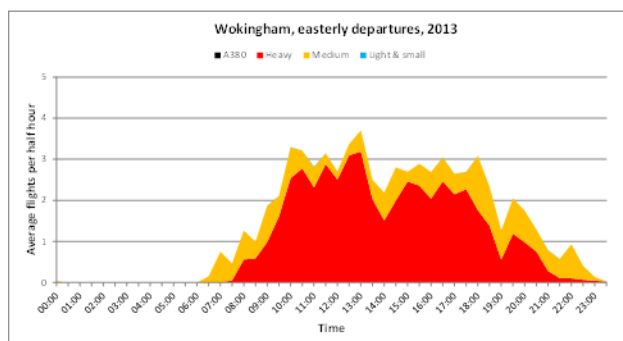
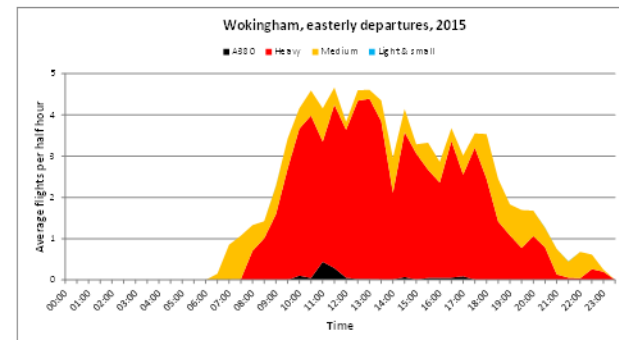
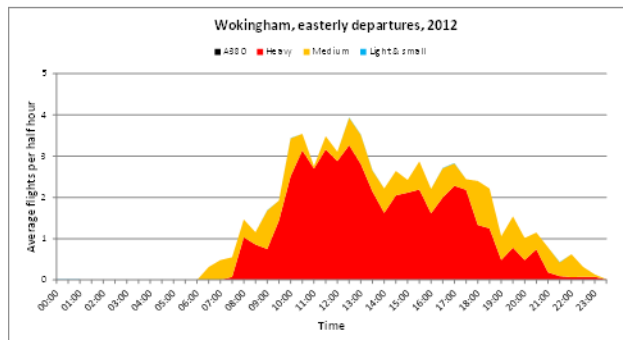
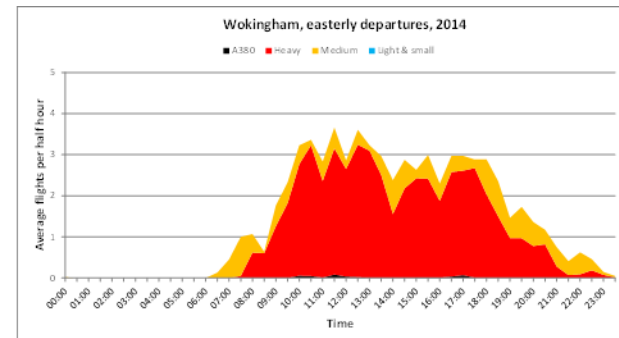
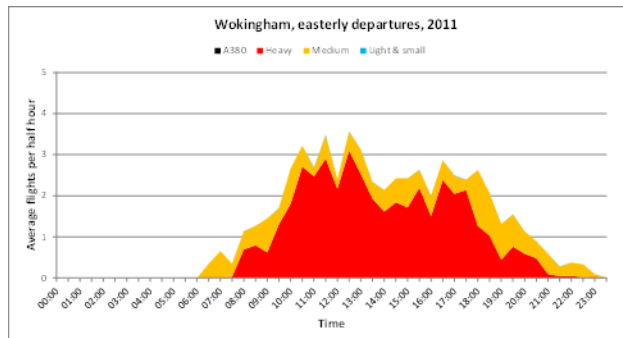
Medium-haul destinations typically have flight times between three and six hours

Long-haul destinations typically have flight times between six and nine hours

Ultra long-haul destinations typically have flight times greater than nine hours

Destinations marked as “unknown” do not have a recognised airport code associated with the flight in the data used for analysis

The peak in the easterly departure traffic occurs between 10:00 hours and 14:00 hours with lower levels at other times: the peak level increased from 2014 to 2015

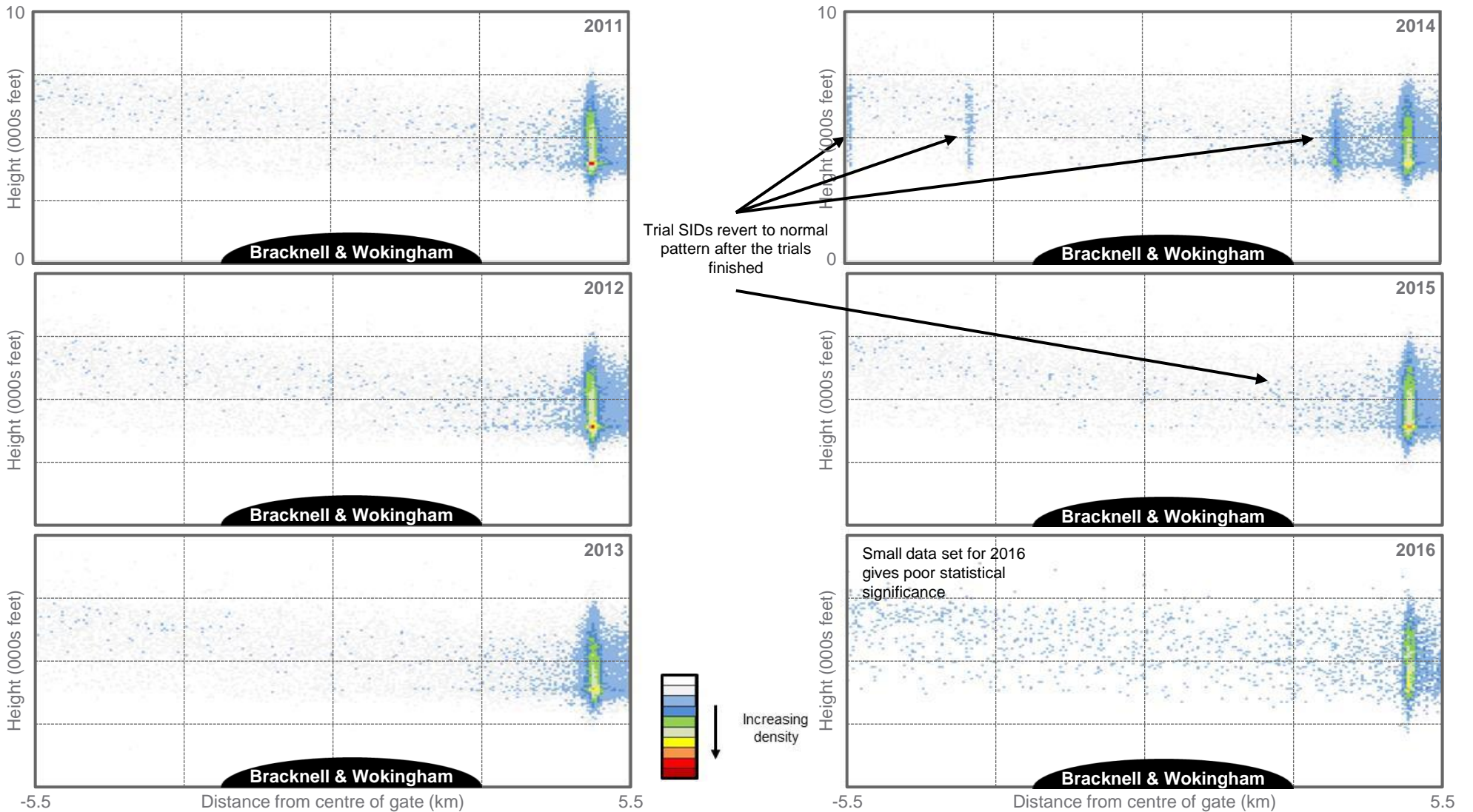




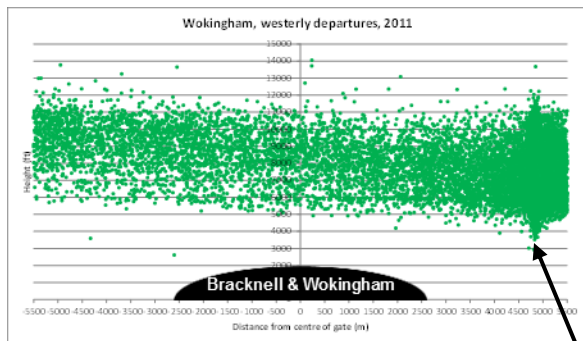
WESTERLY DEPARTURES

5

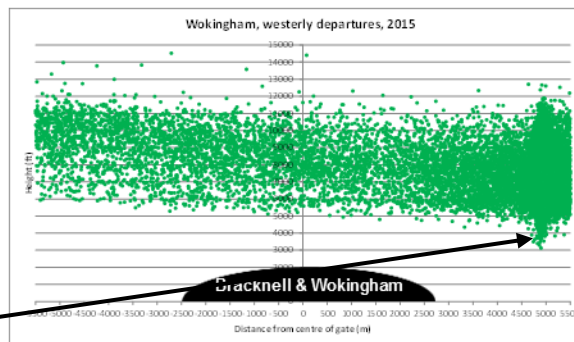
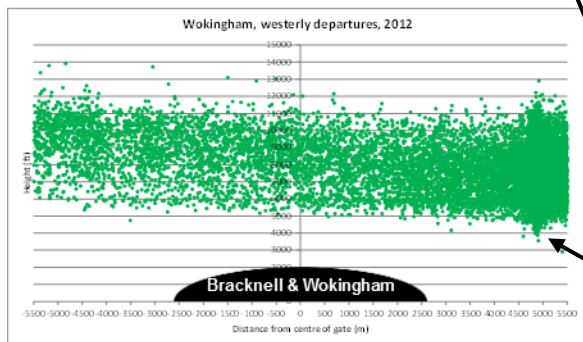
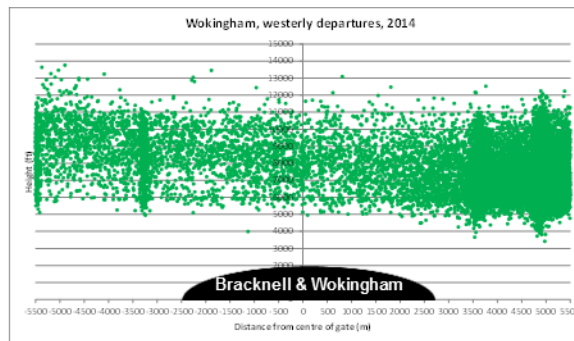
Other than during the trial period, westerly departures occupy a narrow swath to the right edge of the gate with a scatter of lower intensity traffic across the gate



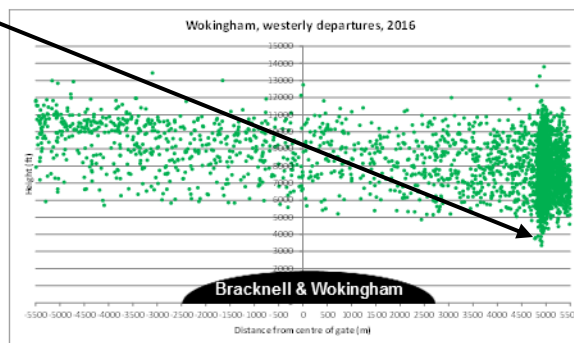
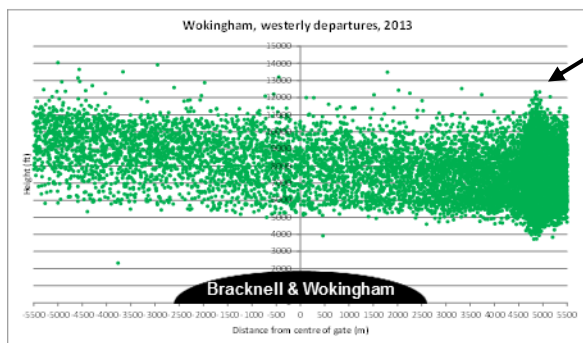
Scatter plots for westerly departures show that traffic is spread across the gate but illustrate the position of the main swath towards the north of the gate



Trial SIDs revert to normal pattern after the trials finished

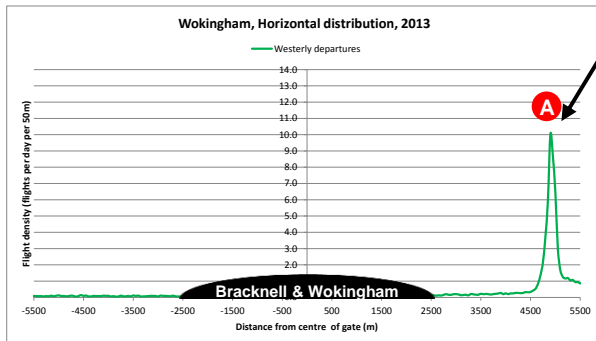
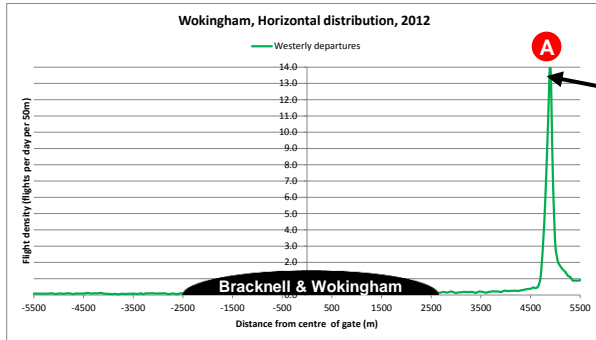
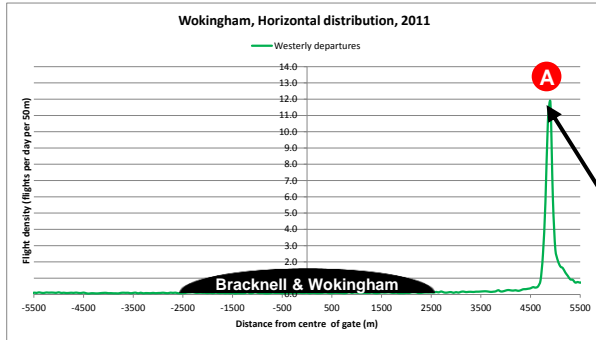


Main swath

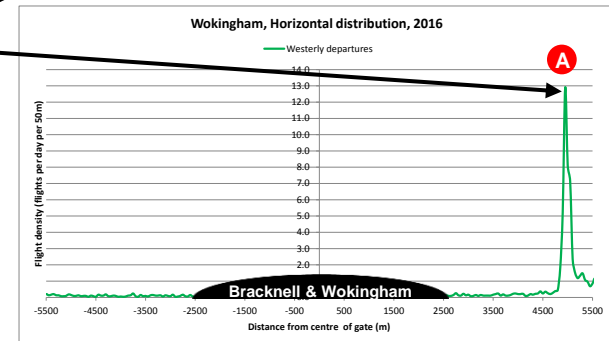
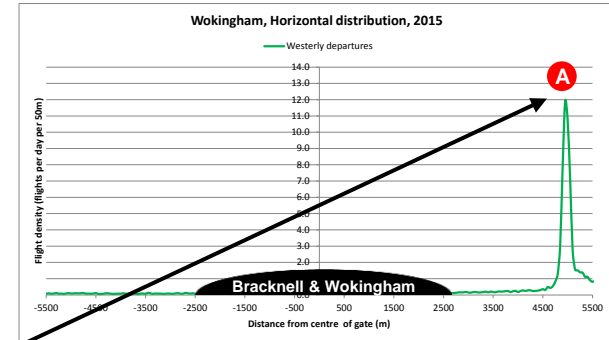
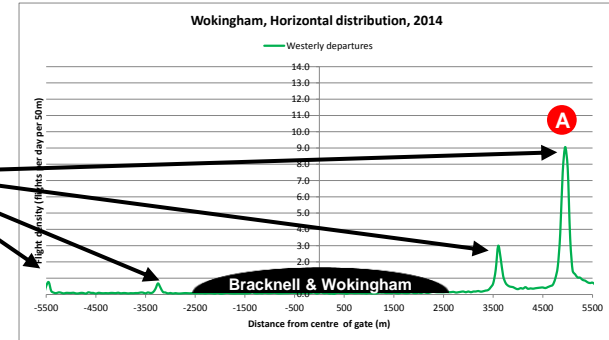


There are far fewer flights recorded for 2016 because the sample only includes two months to the end of February 2016

Westerly departure horizontal traffic distributions show that the traffic intensity in the peak has increased since the trials but was highest in 2012



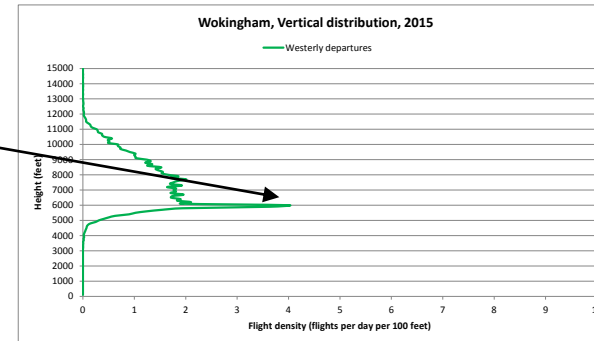
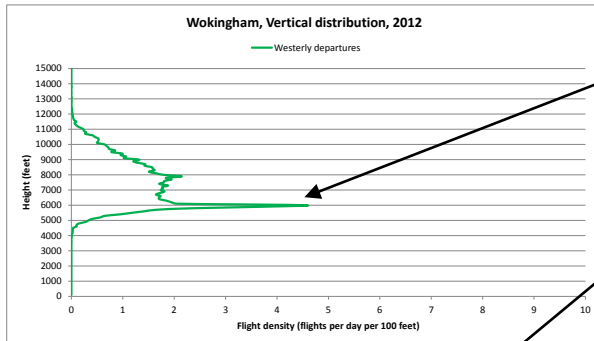
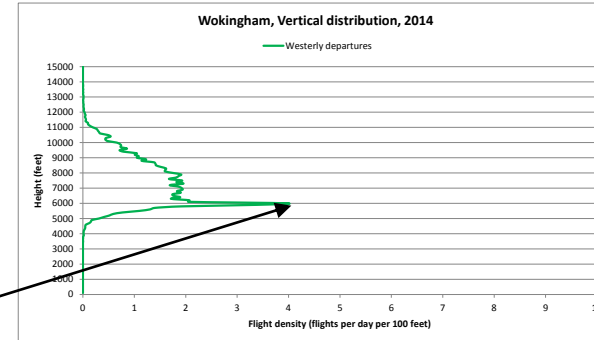
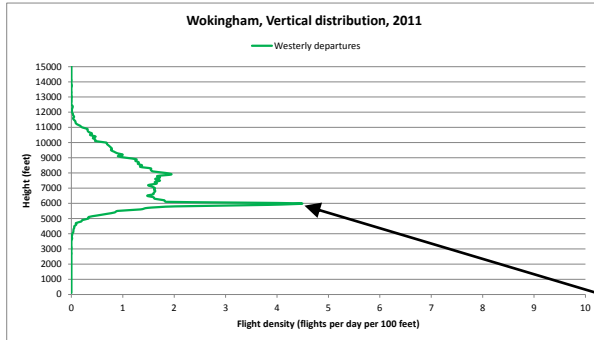
The trials distribute the traffic normally in the peak, A, into the other trial SIDs



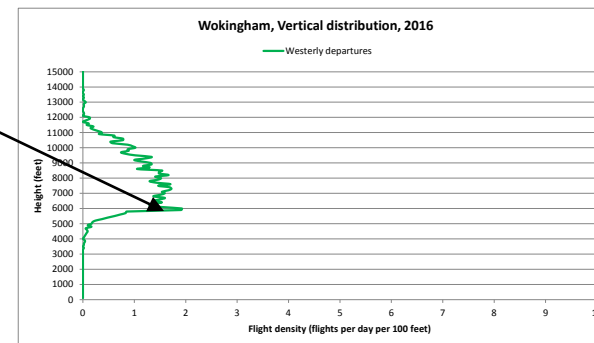
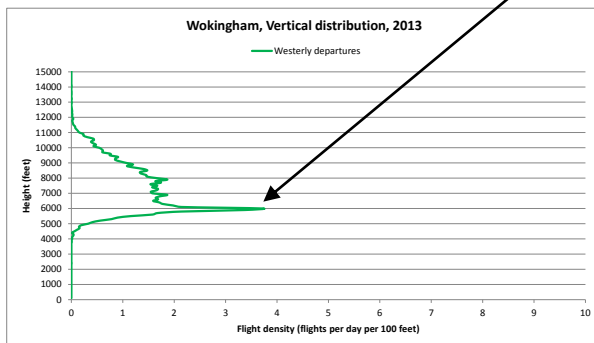
The main peak, A, increases from 2011 to 2012 and then decreases to 2013

The main peak, A, increases after the trials but has not yet reached its 2012 level

Vertical distributions show that the most likely westerly departure height at the gate is consistent at 6000 feet, although this peak is smaller in the limited 2016 data set

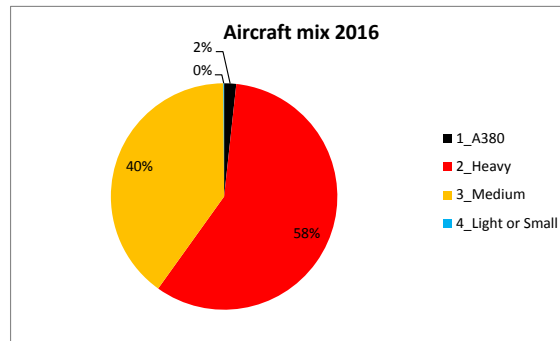
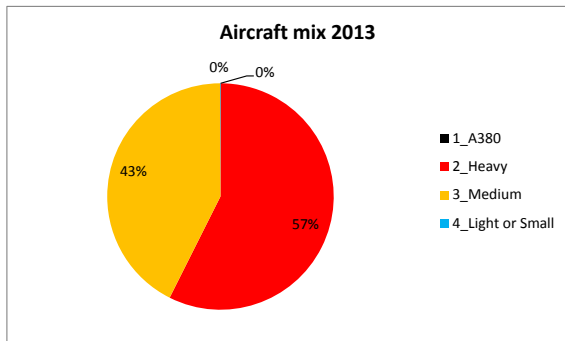
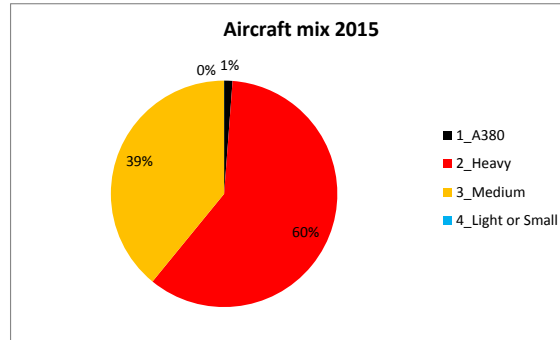
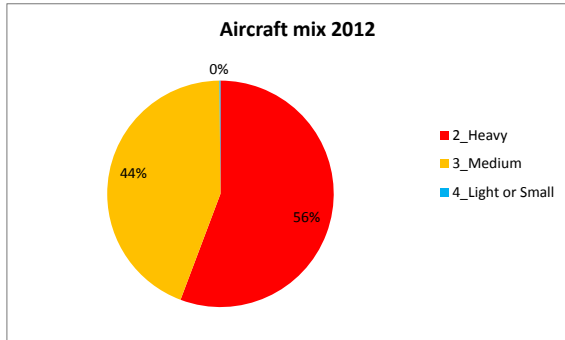
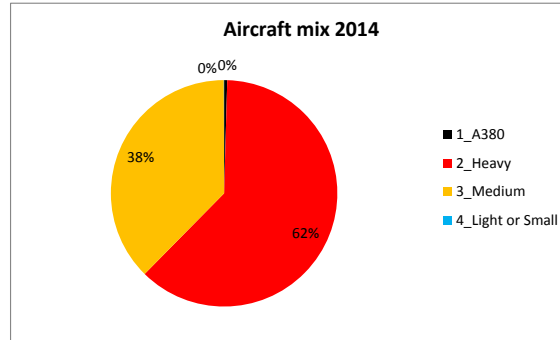
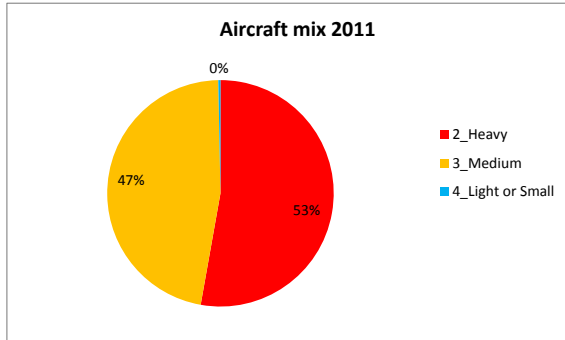


Peak indicates that the most likely height for westerly departures crossing the gate is 6000 feet

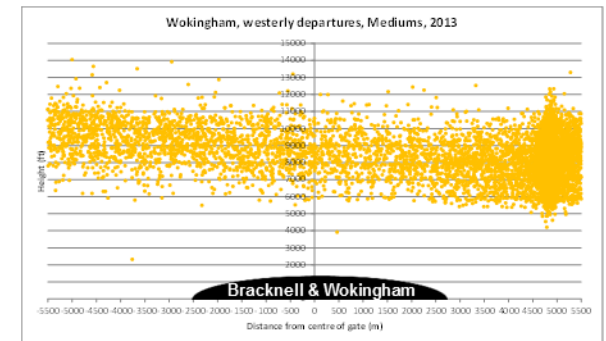
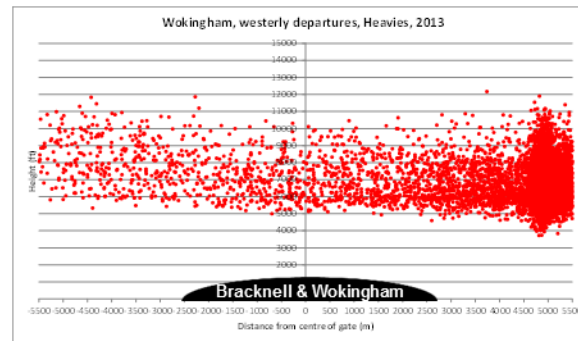
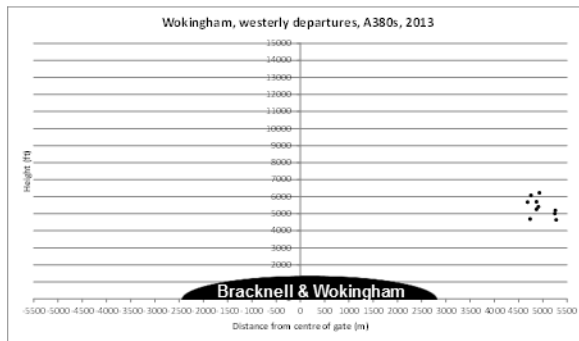
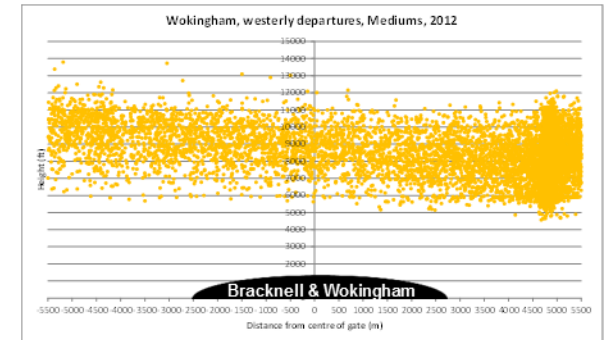
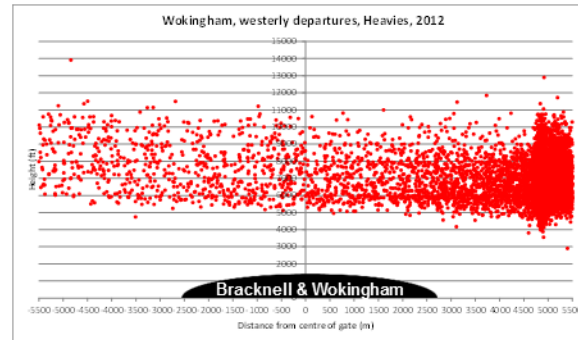
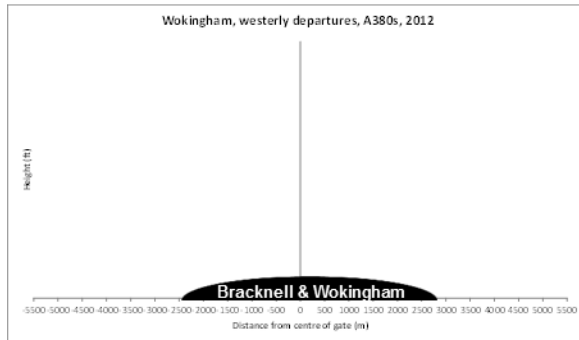
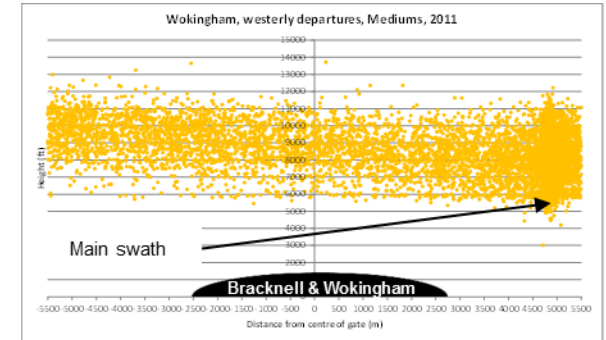
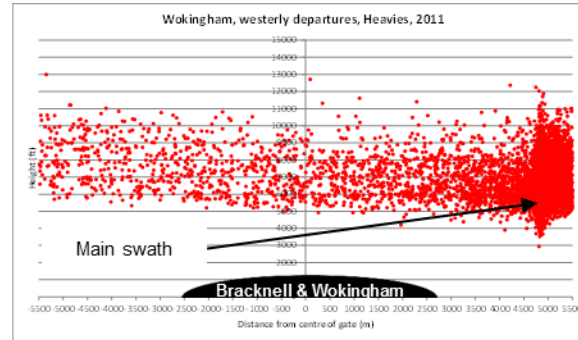
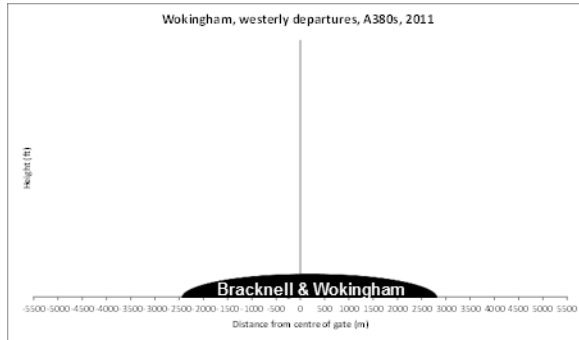


6000 feet peak is reduced in the 2016 data set but this might be due to the limited data available

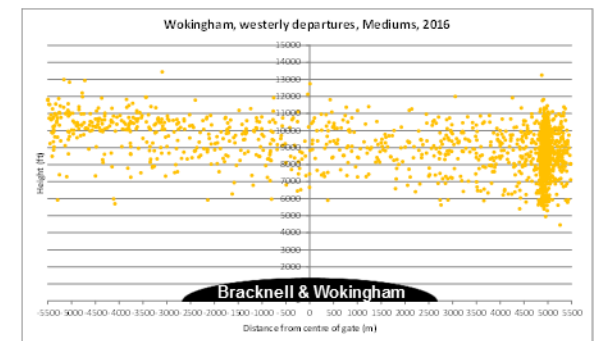
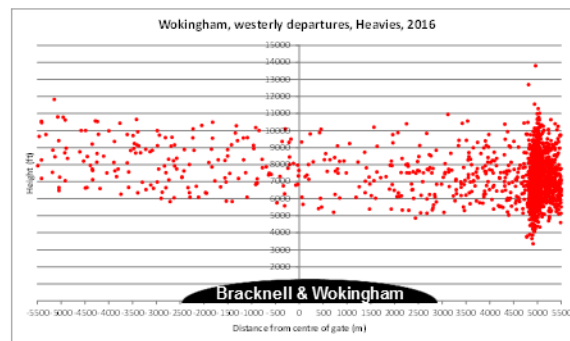
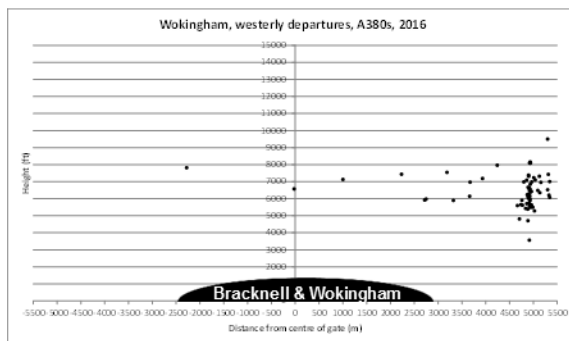
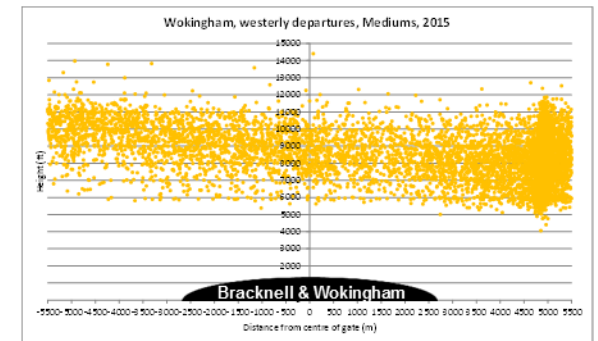
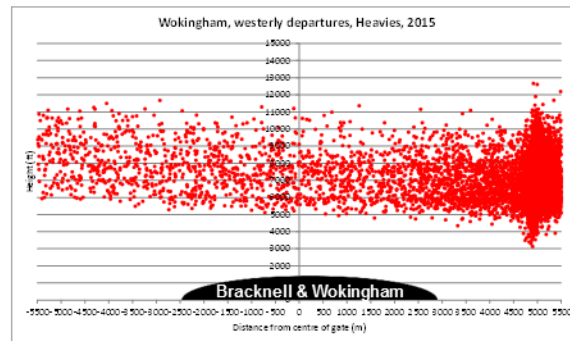
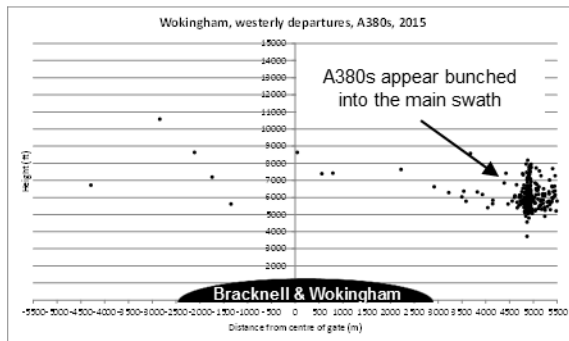
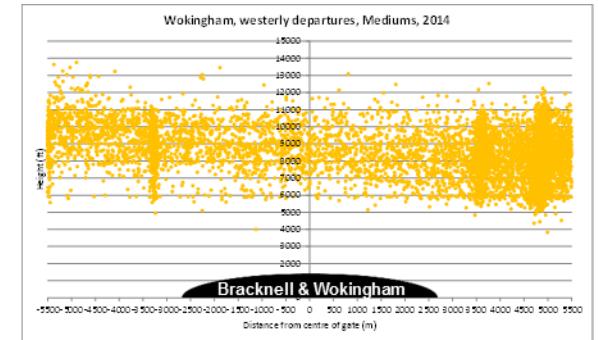
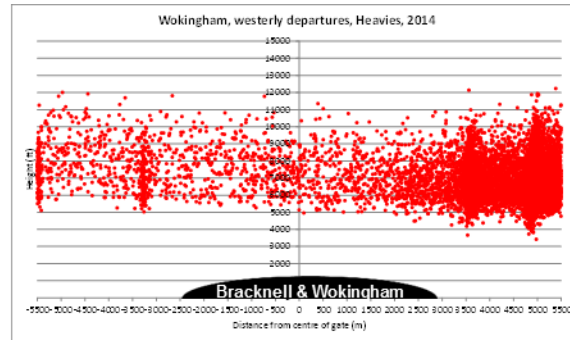
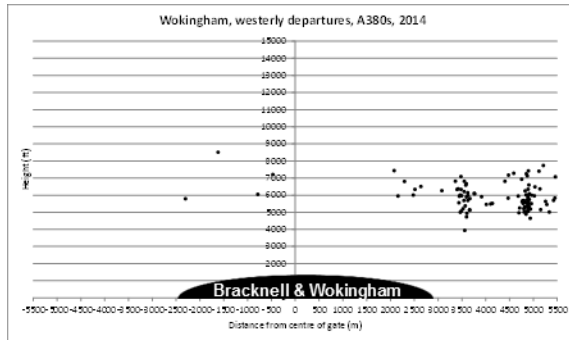
The proportion of large aircraft in the westerly departure mix has increased from 53% in 2011 to 61% in 2015 and 60% in 2016: A380s are currently 2% of the total



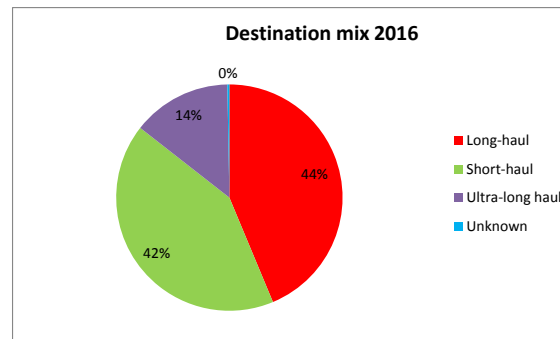
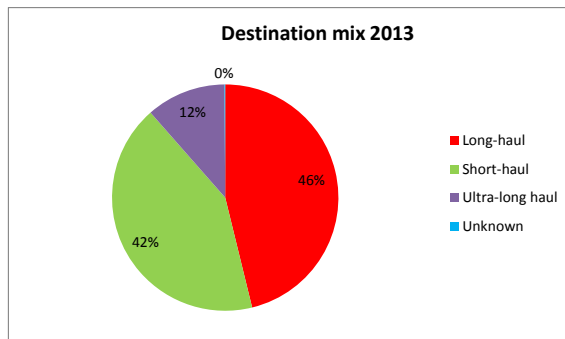
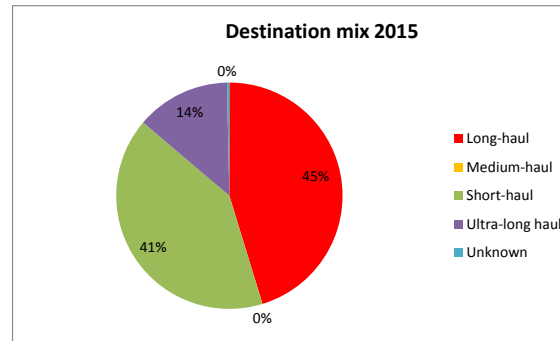
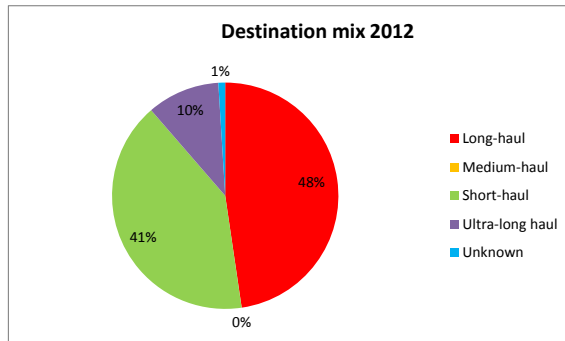
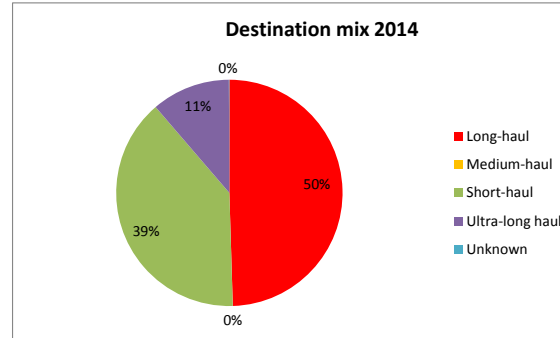
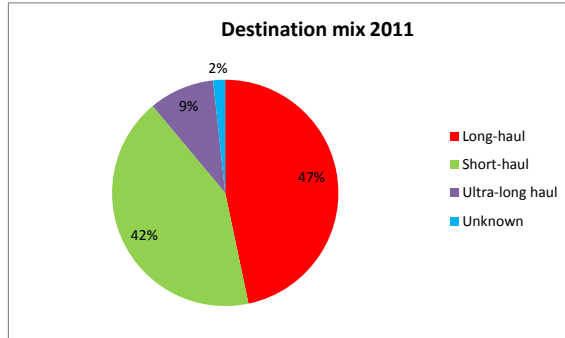
Scatter plots for 2011 to 2013 show the main swath and the broad distribution of traffic across the gate but do not indicate bunching by aircraft size



Similarly scatter plots for 2014 to 2016 show the main swath and the impact of the trial in 2014 but suggest that A380s are bunched in the main swath



The proportion of ultra long haul destinations in the mix has increased from 9% in 2011 to 14% in 2016 as long-haul has been swapped to ultra-long haul



Short-haul destinations typically have flight times shorter than three hours

Medium-haul destinations typically have flight times between three and six hours

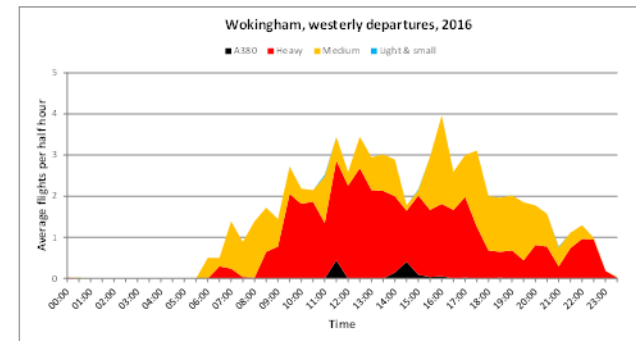
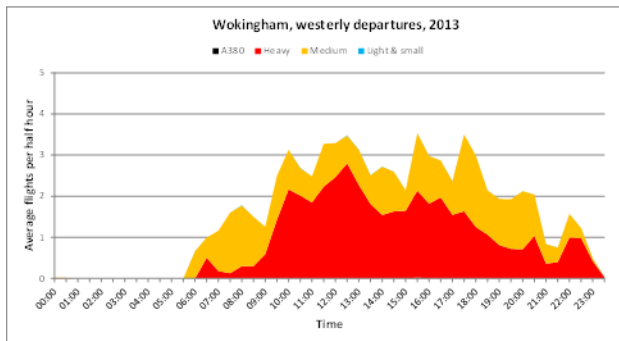
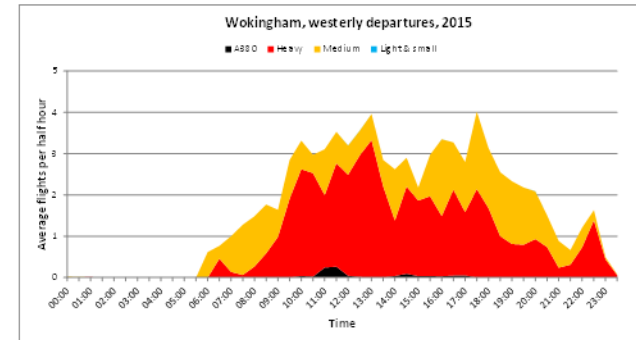
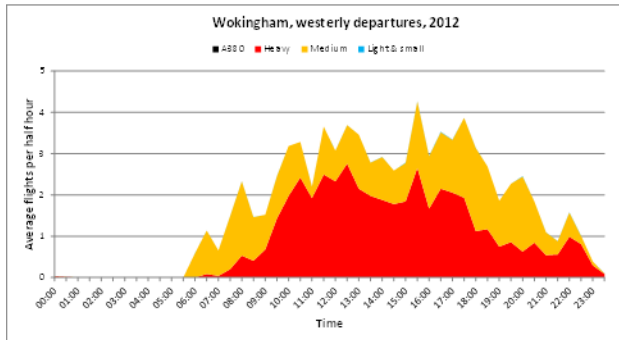
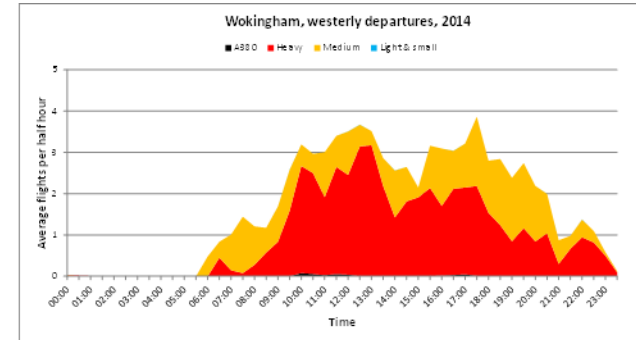
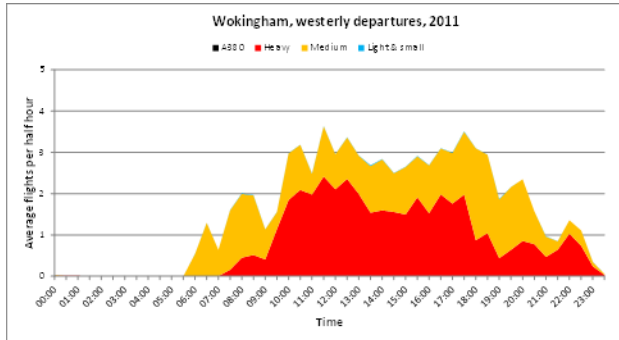
Long-haul destinations typically have flight times between six and nine hours

Ultra long-haul destinations typically have flight times greater than nine hours

Destinations marked as “unknown” do not have a recognised airport code associated with the flight in the data used for analysis

The charts show that the proportion of ultra-long haul has increased from 9% to 14%, short-haul has remained constant at 42% and long haul has decreased from 47% to 44% between 2011 and 2016. This implies a switch from long haul to ultra-long haul destinations

There is a broad peak in westerly departure traffic crossing the gate extending from 09:00 to 20:00 hours with lower levels from 06:00 to 09:00 and 20:00 to 23:30 hours

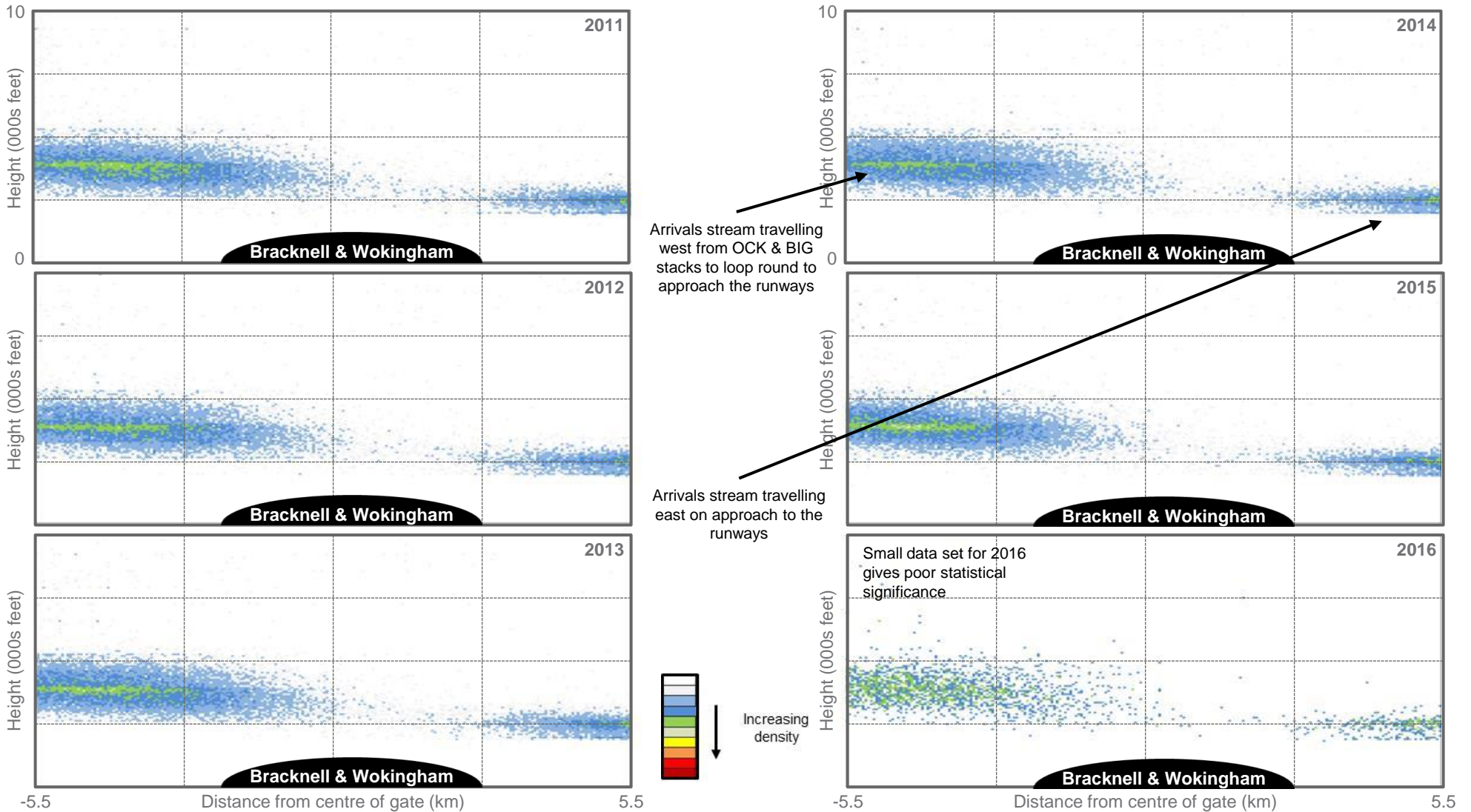




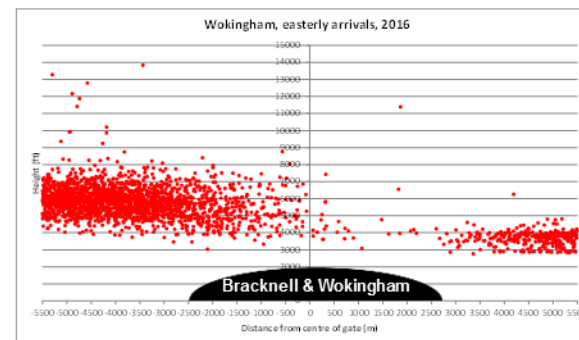
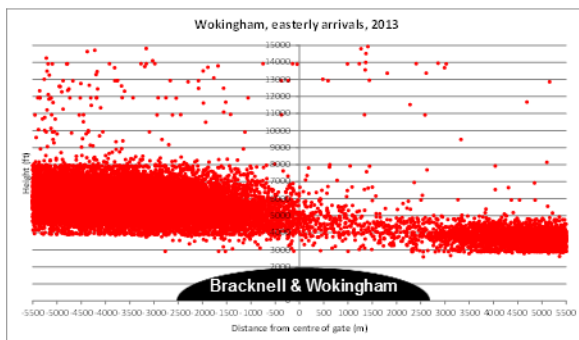
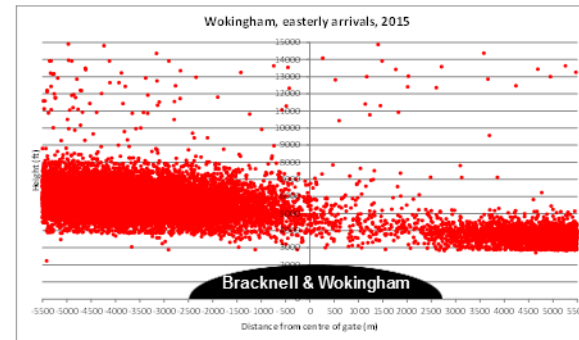
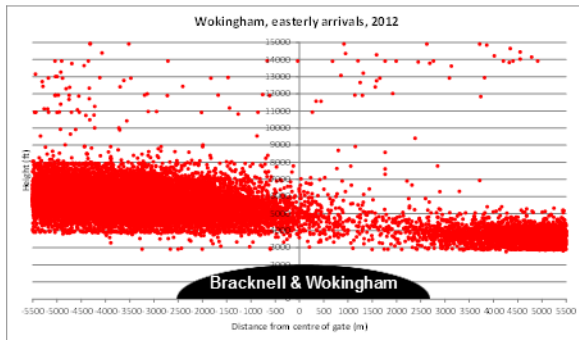
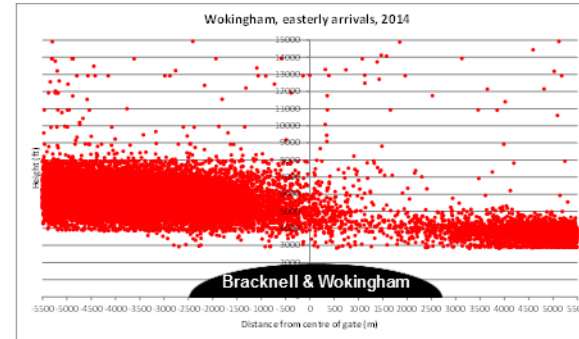
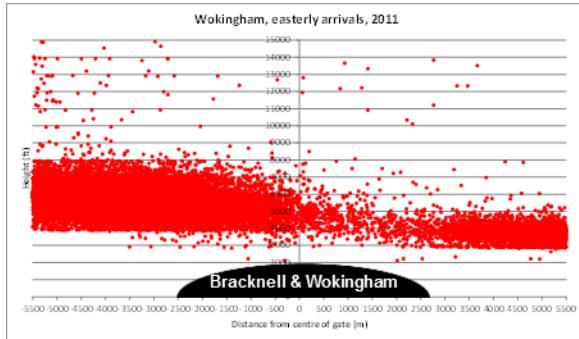
EASTERLY ARRIVALS

6

The easterly arrivals heat maps are consistent over the period 2011 to 2015 indicating little change in flows and concentrations

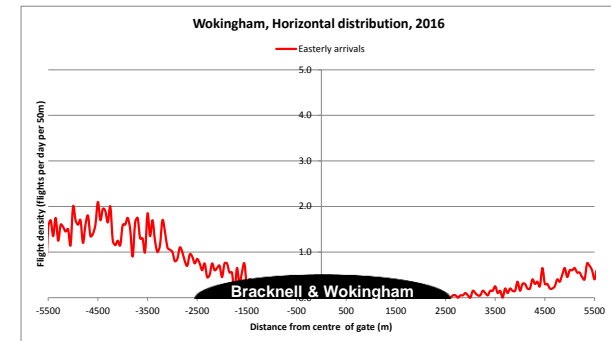
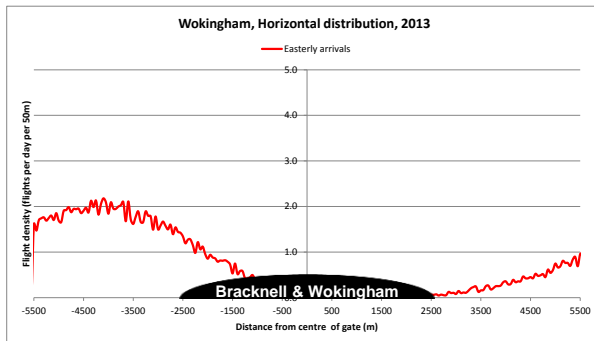
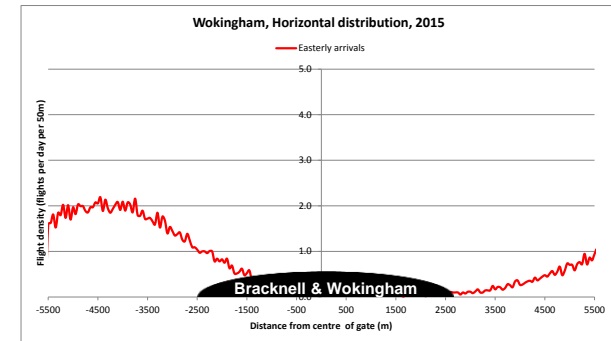
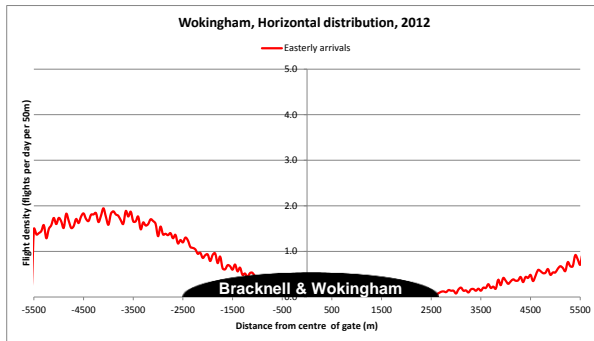
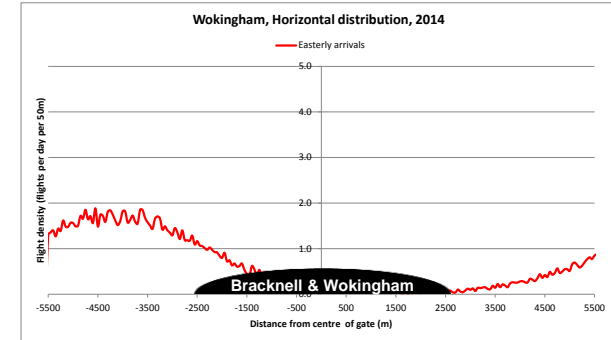
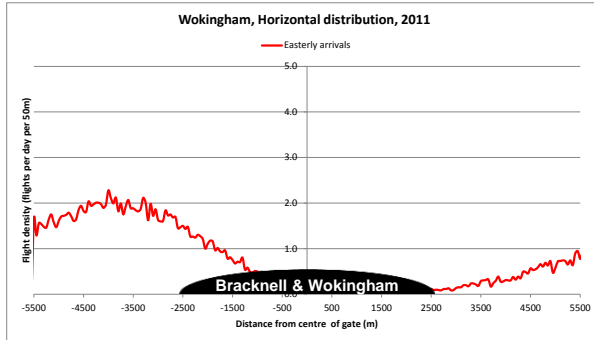


Scatter plots for easterly arrivals illustrate the consistency in traffic patterns from 2011 to 2016



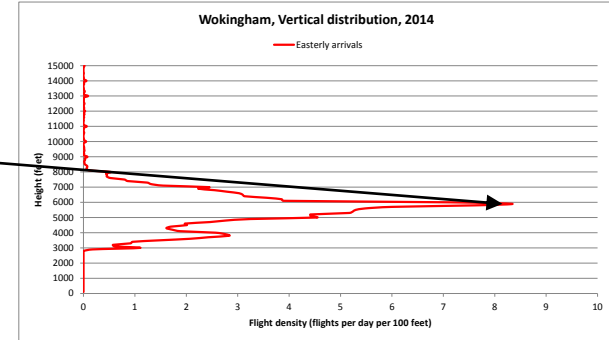
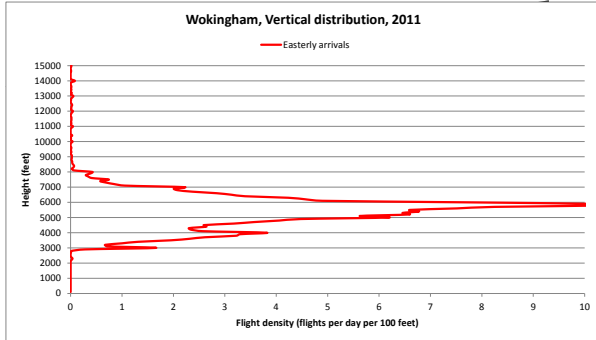
There are far fewer flights recorded for 2016 because the sample only includes two months to the end of February 2016

The horizontal traffic distributions are also very similar from 2011 to 2016

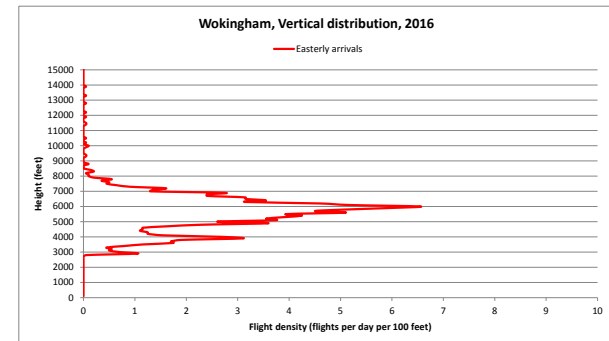
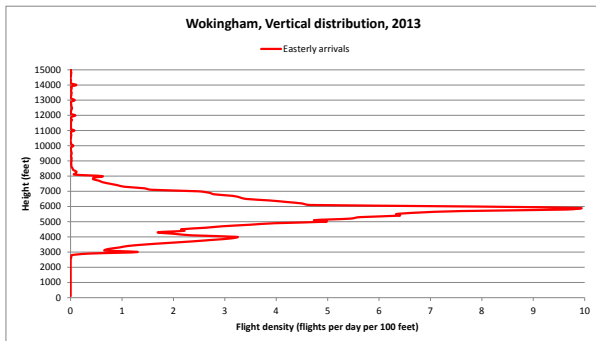
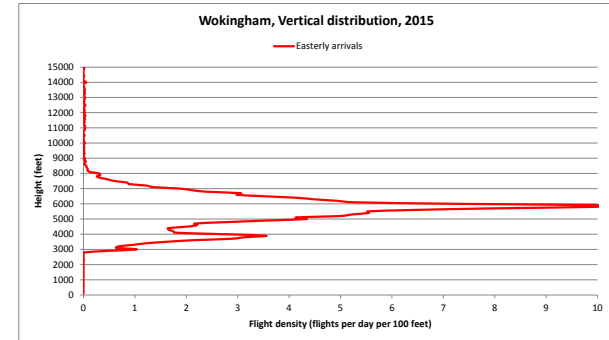
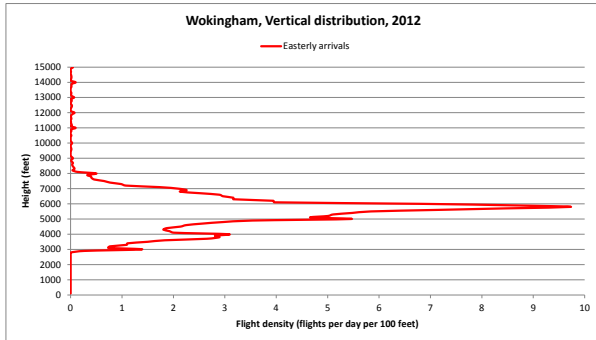


The statistics for the 2016 sample are not as good as the other years because of the small sample size for 2016

Other than for 2014 when the peak at 6000 feet is reduced and 2016 with poor statistics, vertical distributions are consistent

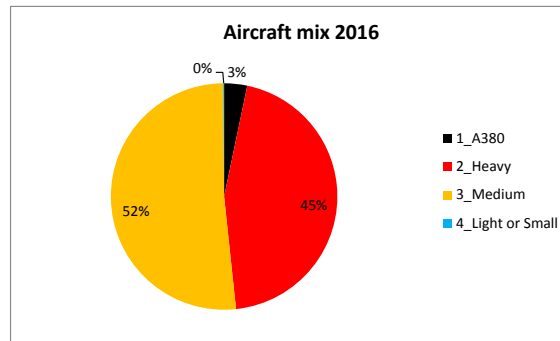
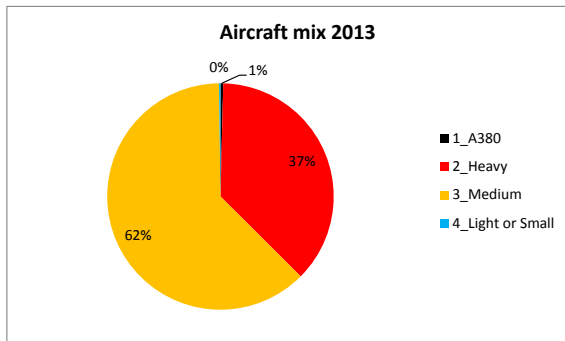
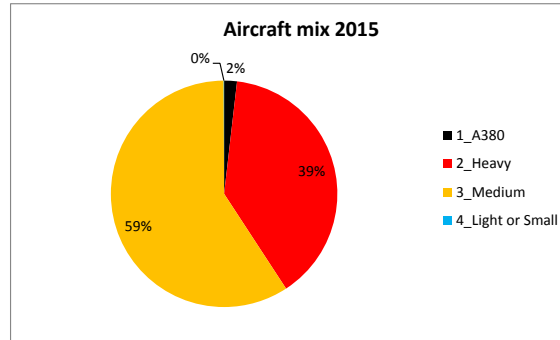
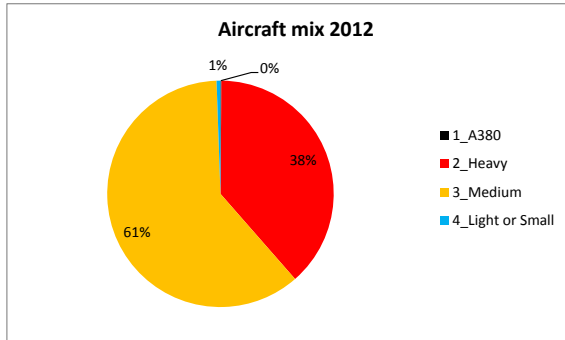
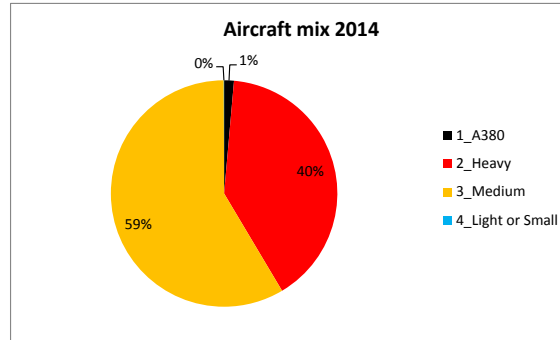
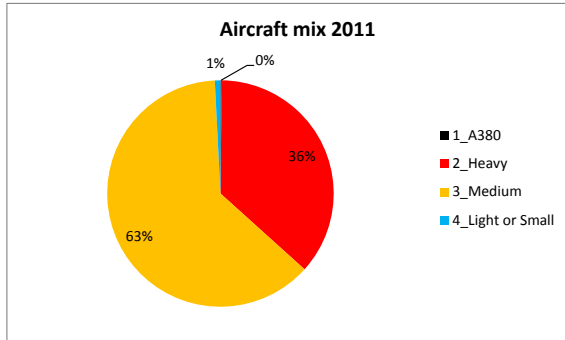


Main peak at 6000 feet is reduced in intensity in 2014 compared to other years

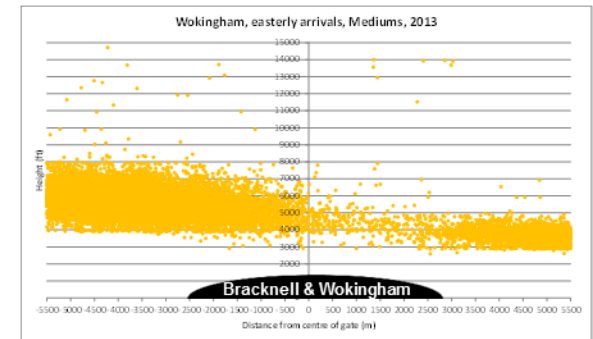
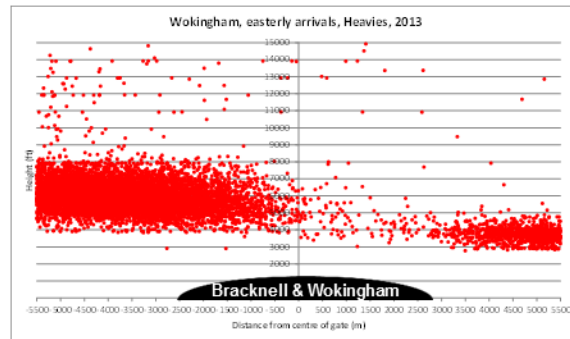
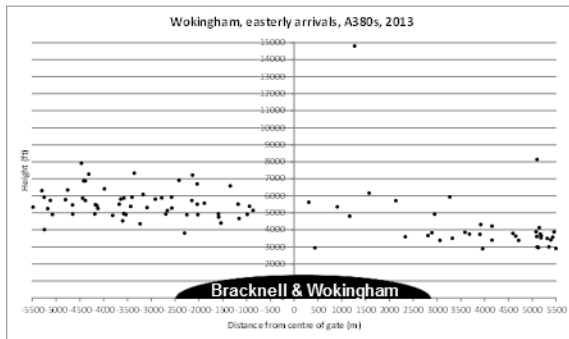
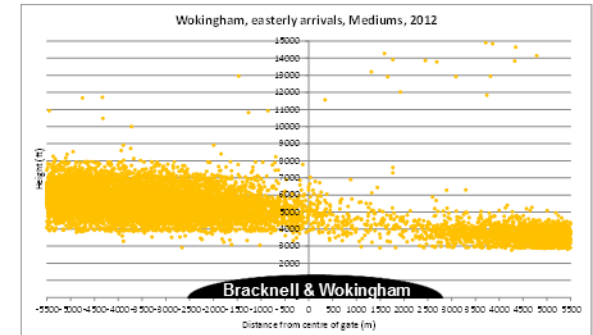
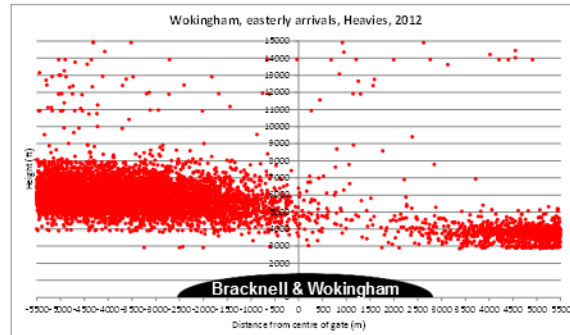
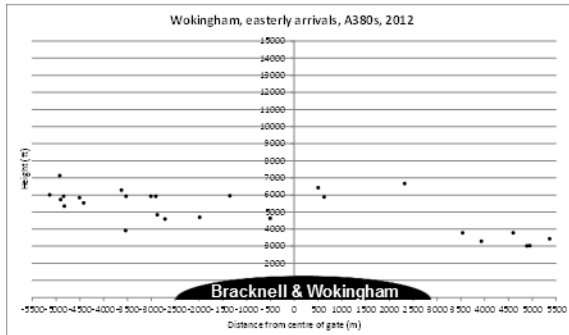
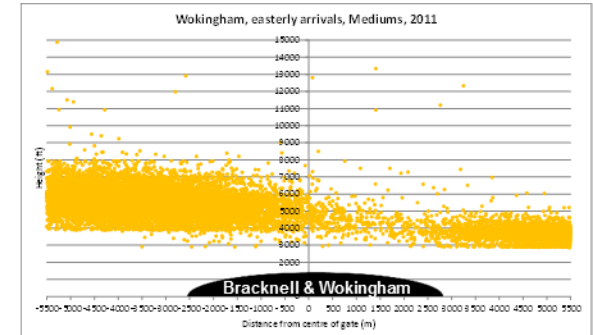
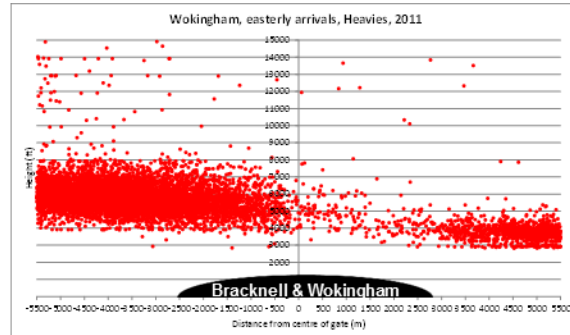
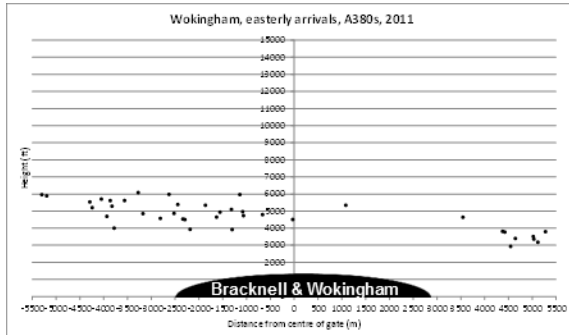


The statistics for the 2016 sample are not as good as the other years because of the small sample size for 2016

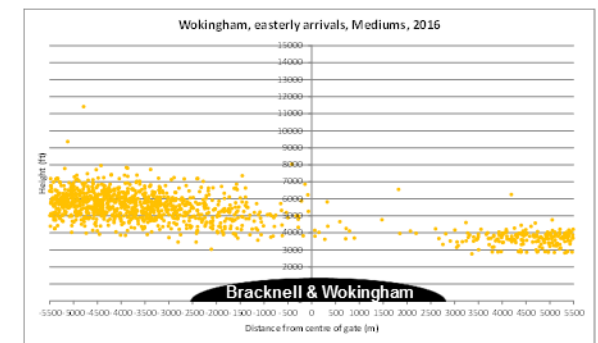
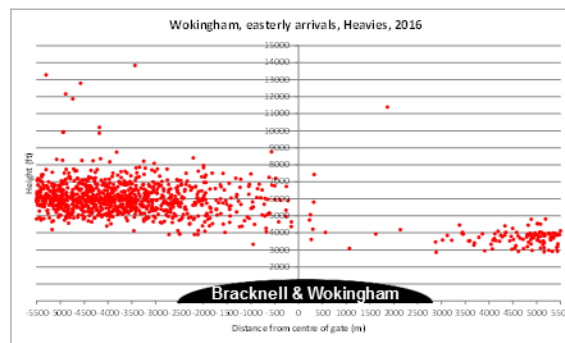
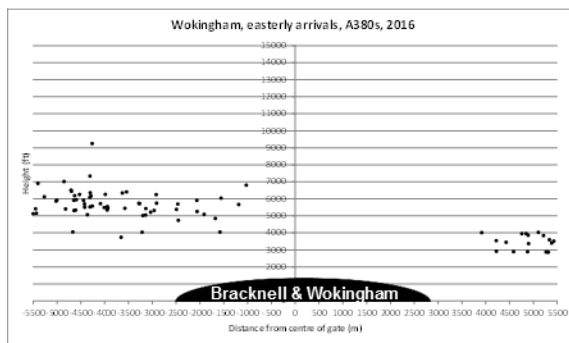
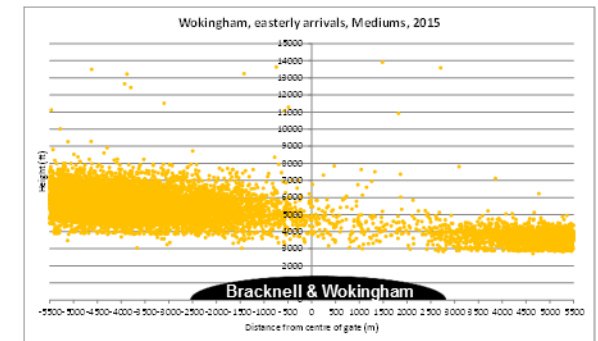
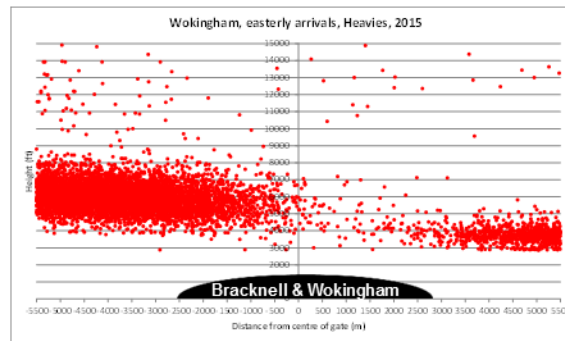
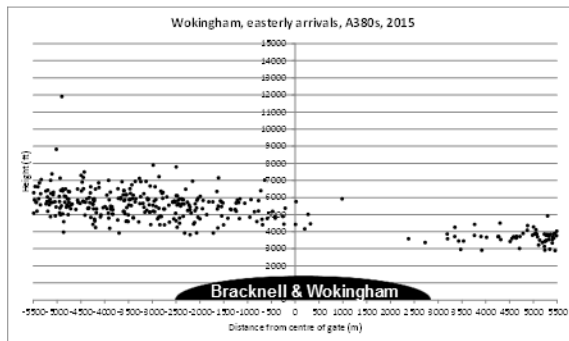
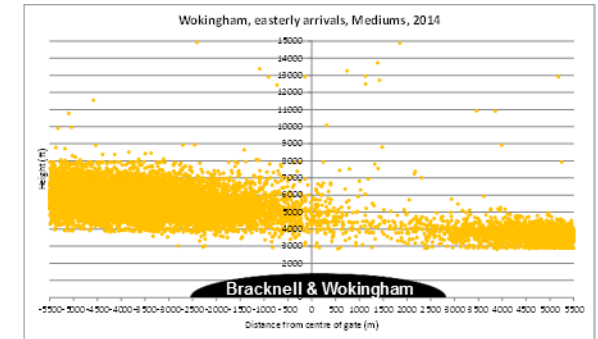
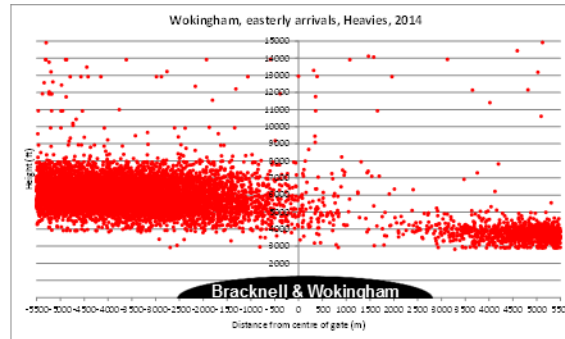
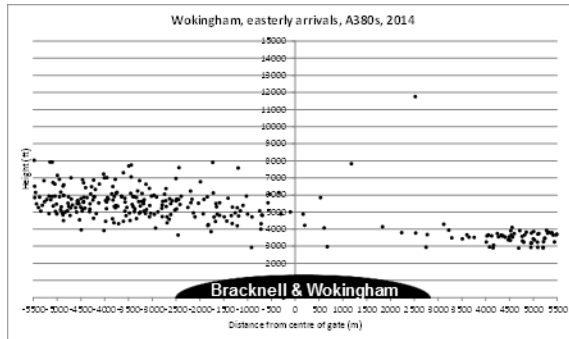
The proportion of large aircraft in the easterly arrivals mix has increased from 36% in 2011 to 42% in 2015 and 48% in 2016, with A380s making up 3% of the total



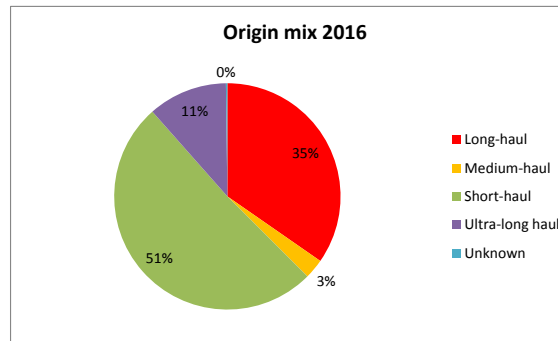
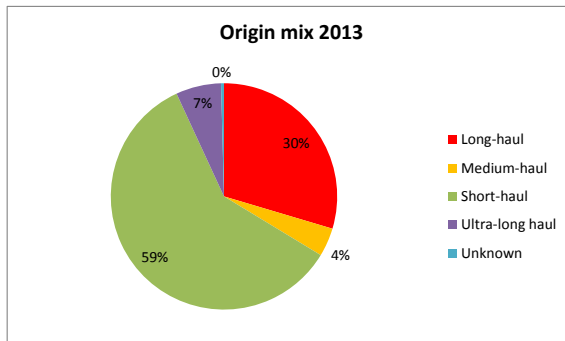
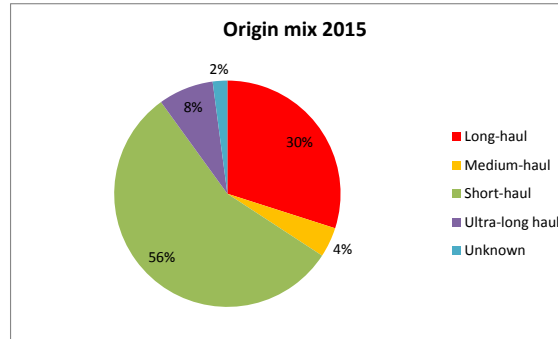
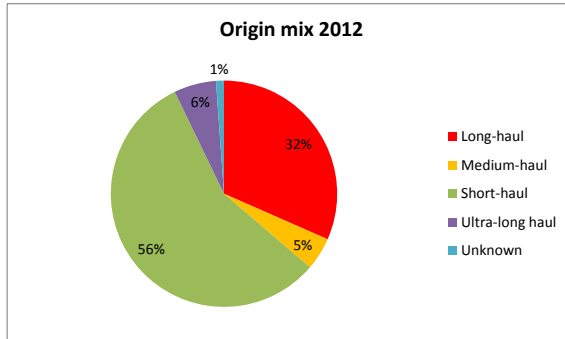
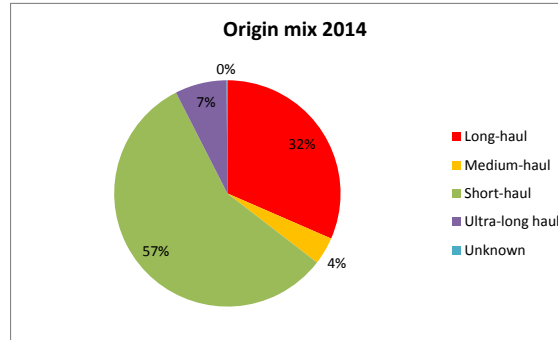
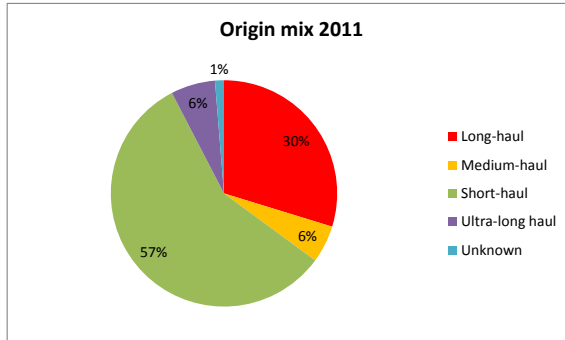
There does not appear to be any bunching by size of aircraft from 2011 to 2013



There also does not appear to be any bunching by aircraft size from 2013 to 2015: aircraft of all sizes are equally distributed across the two streams



The proportion of ultra long and long-haul origins served by easterly arrivals traffic has increased from 36% in 2011 to 38% in 2015 and 46% in 2016



Short-haul destinations typically have flight times shorter than three hours

Medium-haul destinations typically have flight times between three and six hours

Long-haul destinations typically have flight times between six and nine hours

Ultra long-haul destinations typically have flight times greater than nine hours

Destinations marked as “unknown” do not have a recognised airport code associated with the flight in the data used for analysis

Easterly arrivals traffic volume is uniform from 06:00 to 21:30 hours with lower levels from 04:30 to 06:00 and after 21:30 hours: heavy traffic peaks in the early morning

