Preferential Runway Weather Data

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1 Runway Preference

1.1 Introduction

Normally the *runway-in-use* is selected to most closely align to the prevailing surface wind direction. If the surface wind is light and variable then the principal consideration should be the 2,000 ft wind in the vicinity of the airport. Other factors that will be considered when selecting the runway-in-use include local adjacent air traffic patterns, the length of runways available, position of the sun, or moon, the approach aids available and other prevailing meteorological conditions.

Figure 1 below provides a simplified flow diagram of an airport using the conventional single runway operations where the same runway direction is used for departures and arrivals; Figure 2 shows the issues associated with departures and arrivals from opposite direction runways.

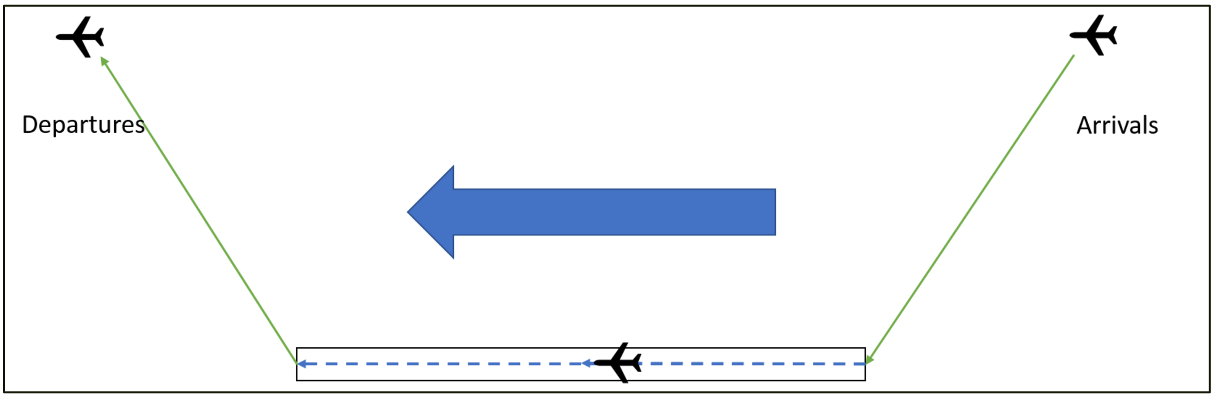

Figure 1 - Diagram demonstrating same runway operations

1.2 Selecting Runway preference

Whenever possible pilots would prefer to land into a headwind. The advantage of landing in a headwind is that the relative speed of the air over the wing is higher, generating more lift, meaning an aircraft can approach a runway at a lower ground speed. This will have the effect of reducing the length of runway required when landing.

A tailwind will have the opposite effect. The relative speed of the air over the wing is lower, so the aircraft will have to approach the airfield at a higher ground speed. This will have the effect of increasing the length of runway required, landing distance, as the aircraft will be travelling faster when it lands.

CAP 493 gives guidance on the constraints for selecting a runway for noise abatement purposes. It states:

> *"Noise abatement shall not be the determining factor in runway nomination, when it is known that the crosswind component, including gusts exceeds 15kt, or the tailwind component, including gusts exceeds 5kts."*

This statement implies that a runway should only be selected for noise abatement if the tailwind is 5kts or less. This report will examine runway length required with a tailwind of 5kts.

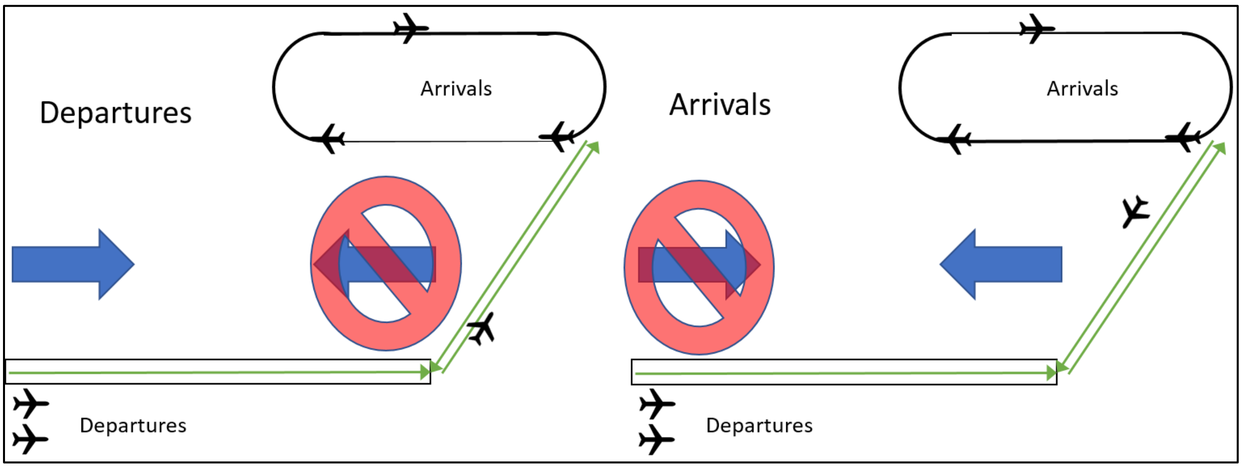

Figure 2 - Diagram demonstrating opposite direction runway operations on the same runway

Utilising a runway in deference to the ideal wind conditions has the risk of causing a higher rate of unsuccessful landings, increasing the number of aircraft forced to conduct a circuit to attempt a successful landing or executing a Missed Approach Procedure. Any of these events would undermine the noise reduction benefits associated with preferential runway selection; indeed, they could make them significantly worse with aircraft operating at high power settings in close proximity of the airport.

1.3 Application at Manston

The town of Ramsgate is located to the east of Manston Airport, and a large area of predominately agricultural land is located to the west. To limit the noise experienced by the residents of Ramsgate it would be ideal to operate with aircraft landing from, and taking off to, the west. That said, this must be balanced against any impact on other conurbations such as Herne Bay.

Utilising one runway for arrivals and the opposite runway for departures can create significant operational challenges. For these kinds of operations, the airspace utilised for departures and arrivals is the same and therefore only one action can take place at any one time, whereas in conventional operations departures and arrivals can be safely separated. This will dramatically reduce the flow-rate of an airport and lead to an increased workload for ATC as aircraft may be required to join a holding pattern on arrival or wait extended periods for a departure window. This is particularly the case at Manston where taxiway configurations may limit aircraft moving from their parking stand until a landing aircraft has cleared the runway. That said, it is anticipated that the lower intensity of operations at night, may allow such measures to be accommodated with little operational impact. Equally, the respective positioning of the conurbations of Ramsgate and Herne Bay would mean that the impact of such measures may be significantly different; little can be done to operationally mitigate the impact of aircraft departing and arriving over Ramsgate, less than 2 miles from Manston runway and directly under its centreline, whereas it is anticipated that departures to the west will turn before Herne Bay and arrivals from the west will fly over Herne Bay at approximately 2,500 ft with low power settings. It is therefore anticipated that operational impact associated with considering noise abatement as one factor in deciding runway direction at Manston could be managed. This could also allow the noise experienced by local residents to be more pro-actively managed than previously.

1.4 Manston Preferential Runway Strategy

As mentioned in Section 1.3, the preferred runway option for Manston Airport would be for aircraft to land on Runway 10 and take off from Runway 28 (aircraft landing from, and taking off to, the west), however this will not always be achievable due to prevailing wind and runway conditions. If this option is not possible, then the next preferred option would be for Runway 28 to be used for both take-offs and landings, as landing aircraft are quieter than aircraft taking off, so the residents of Ramsgate would experience the quieter of the two actions. The last choice would be to use Runway 10 because this would expose Ramsgate to the most noise. The modes described above are summarised in Table 1 below:

Mode	Take Off Direction	Landing Direction
Mode 1	RWY 28	RWY 10
Mode 2	RWY 28	RWY 28
Mode 3	RWY 10	RWY 10

Table 1 - Preferential Runway Modes

Mode 1 would be the preferential option for Manston Airport and would only have to be changed to a different Mode as a result of the following triggers:

1. The movement rate (intensity) required is too high to be supported by opposite direction operations;
2. The tailwind component is too high for landing on Runway 10, in which case Manston Airport would have to operate in Mode 2;
3. The tailwind component is too high for take-offs on Runway 28, in which case Manston Airport would have to operate in Mode 3; and
4. Wet or contaminated runway conditions necessitates the use of reverse thrust, in which case Manston Airport would have to operate on the in-to-wind runway, in either Mode 2 or Mode 3.

Similarly, the trigger to change from Mode 2 to Mode 3 operations would be:

5. The tailwind component is too high for landings or take-offs on Runway 28, in which case Manston Airport would have to operate in Mode 3.

For preferential runway operations to be a successful noise mitigation strategy it is important to see how much of the time Manston Airport could operate in Mode 1. To do this, Manston Airport's critical movement rate (utilising opposite direction operations) must be ascertained and what percentage of the time the prevailing weather conditions preclude Mode 1.

1.5 Movement Rate

The critical movement rate is the movement rate that cannot be exceeded at Manston Airport whilst utilising opposite direction operations.

Movement rate can be an important factor in the success of an airport. In 2013 London Gatwick Airport, the world's busiest single-runway airport, could handle 54 movements per hour. Critically this means that each aircraft has about one minute of the runway's time before the runway needs to be utilised again. This number of movements per hour is reached by slick operational processes and the advantage of aircraft landing and departing in the same direction.

As alluded to in Section 1.2, an airport that utilises opposite direction operations will not be able to reach this rate. This is because, the airspace that departing and landing aircraft utilise is the same and the aircraft will need to be carefully managed on the ground to ensure flow is maintained, so there needs to be extended built in separation between aircraft movements.

The limiting factor for the movement rate of opposite direction operations at Manston Airport will be ensuring that aircraft are not delayed in the air. Whilst it is conceivable that an aircraft may have a delayed start time to facilitate opposite direction operations, aircraft operators would not accept delays in the air, which could lead to large fuel consumption costs.

To determine a theoretical maximum movement rate at Manston Airport the following must be considered:

1. The time taken for an aircraft to complete the final stages of approach;
2. The time taken for that aircraft to land, exit the runway and taxi to a stand;
3. The time taken for a departing aircraft to taxi to the runway; and
4. The time taken for that aircraft to take-off, and vacate the approach lane to facilitate the next approach.

The time between each movement would have to include all four of the aspects listed above and the time taken for each is summarised in Table 2 below:

Section	Distance (in nautical miles (nm))	Speed (in kts)	Time (in minutes)
Approach	15	165	5.5
Landing and departing the runway			1.5
Taxi in			3
Taxi out			6
Time on the runway and take-off roll			1.5
Climb out	10	185	3.5

Section	Distance (in nautical miles (nm))	Speed (in kts)	Time (in minutes)
Total			21 minutes
Movements per hour			5

Table 2 - Breakdown of the time required for each movement

Table 2 describes the elements and sequence that would be required for two movements (a departure and an arrival). Due to the nature of the taxiway infrastructure at Manston Airport, when an aircraft is on approach, all aircraft ground movements must cease, as there is insufficient space for an inbound aircraft and an outbound aircraft to taxi simultaneously. As a result, the time it takes for an aircraft to taxi in, and then for the next aircraft to taxi out must be considered, sequentially, in the calculation of the movement rate.

This is a very simplistic method for working out a movement rate, and it is likely that the operational movement rate would be lower than this as this assumes there are no delays during any aspect of the process.

The theoretical movement rate calculated is low and would inhibit operations at Manston Airport, however there are times when this level of movement could be acceptable. It is often the case that movement rates at night are lower than during the day, and this is also the time where noise mitigation techniques are most crucial, as background noise levels are lower, making aircraft noise more of a factor. The lowered movement rate of night time operations could allow for a preferential runway strategy to be feasible at night.

1.6 Prevailing Wind Conditions

Sections 1.2 gave an indication of the parameters in which a preferential runway strategy could be used. This section will use historical Met Office data to explore when the prevailing wind conditions will allow for preferential runway operations. As stated in Section 1.2, there are constraints on the amount of tailwind that is allowable for purely noise abatement purposes, and it may also be the case that individual aircraft operators will have stricter tailwind constraints due to the increased risk associated with tailwind flight operations.

Many airports across the world have preferential runway strategies, for a great range of reasons. They can be to avoid overflying a local population whenever possible, or for the most expeditious arrival or departure conditions due to local airspace or terrain, however they will all be limited by the weather conditions. Examples of airports with preferential runway use include:

- **Birmingham Airport** uses Runway 33 as its preferential runway unless the mean surface wind speed is greater than 5kts or if the runway is not dry.
- **Amsterdam Airport Schiphol** operates a preferential runway system, which is constrained by a 7kts tailwind when the runway friction level is good.

- **Frankfurt Airport** utilises Runway 25 for landings, unless there is a tailwind above 5kts, and departures on Runway 18 will continue with tailwinds in excess of 10kts (although pilots will be notified to allow them to select other runway options).

Importantly, although Amsterdam and Frankfurt have higher limits, as stated above, the UK tailwind limit specific by the CAA is 5kts.

1.6.1 Wind Components

Ten years of wind data was used to gain a comprehensive understanding of the average wind speed and direction at Manston Airport. Fortunately, whilst RAF Manston, and later Kent International Airport closed, the climate station has remained active so the data received is accurate for the proposed Manston Airport site.

The data received details the wind direction and speed, however this report is most concerned with the tailwind component. Wind has both speed and direction, and so like any other vector can be considered as two components working at right angles to each other. These components can be considered as the headwind/tailwind component and the crosswind component as described in Figure 3 below.

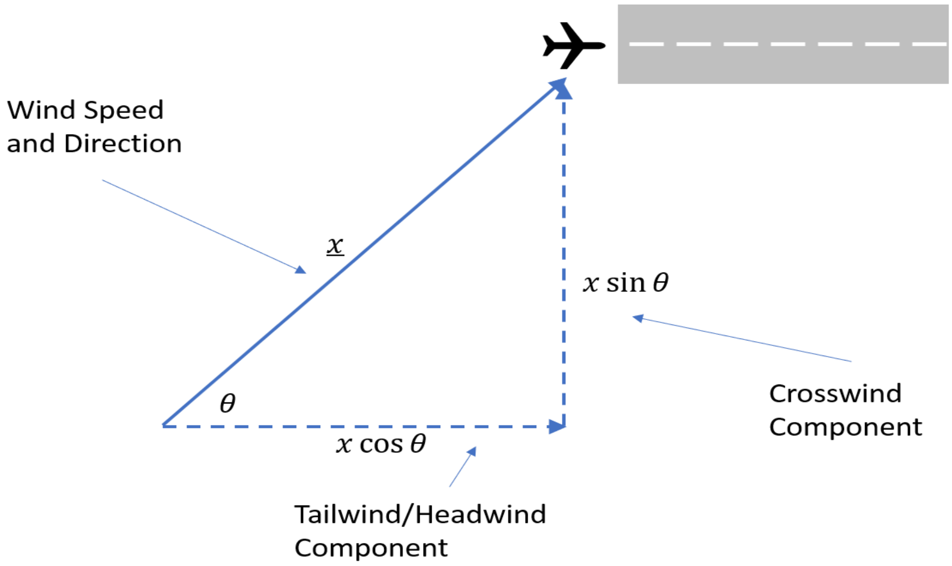

Figure 3 - Wind components for an aircraft approaching a runway

Figure 3 demonstrates that wind can always be broken down into a crosswind, and a tailwind/headwind component. CAP493 states that the tailwind component must not exceed 5kts, however many European airports, as mentioned, operate outside this threshold. Following a review of preferential runway strategies, it was determined that, for the purposes of analysis, 5kts should be the tailwind threshold for aircraft on landing and take-off. The data received from the Met Office was therefore evaluated to determine the percentage of time Runway 10 can be used for landings, and Runway 28 for take-offs, where the tailwind component is less than 5kts.

1.6.2 Met Office Data

The Met Office data comes in the form of a wind rose that shows the percentage of time wind is at certain speeds and directions. An example of a Manston climate station wind rose is shown at Figure 4. This wind rose shows the percentage of time (0 to 20% in Figure 4) the wind was in a given direction and at what speed. This data is taken from January 2006 to December 2015, so it gives a comprehensive assessment of normal wind characteristics at Manston.

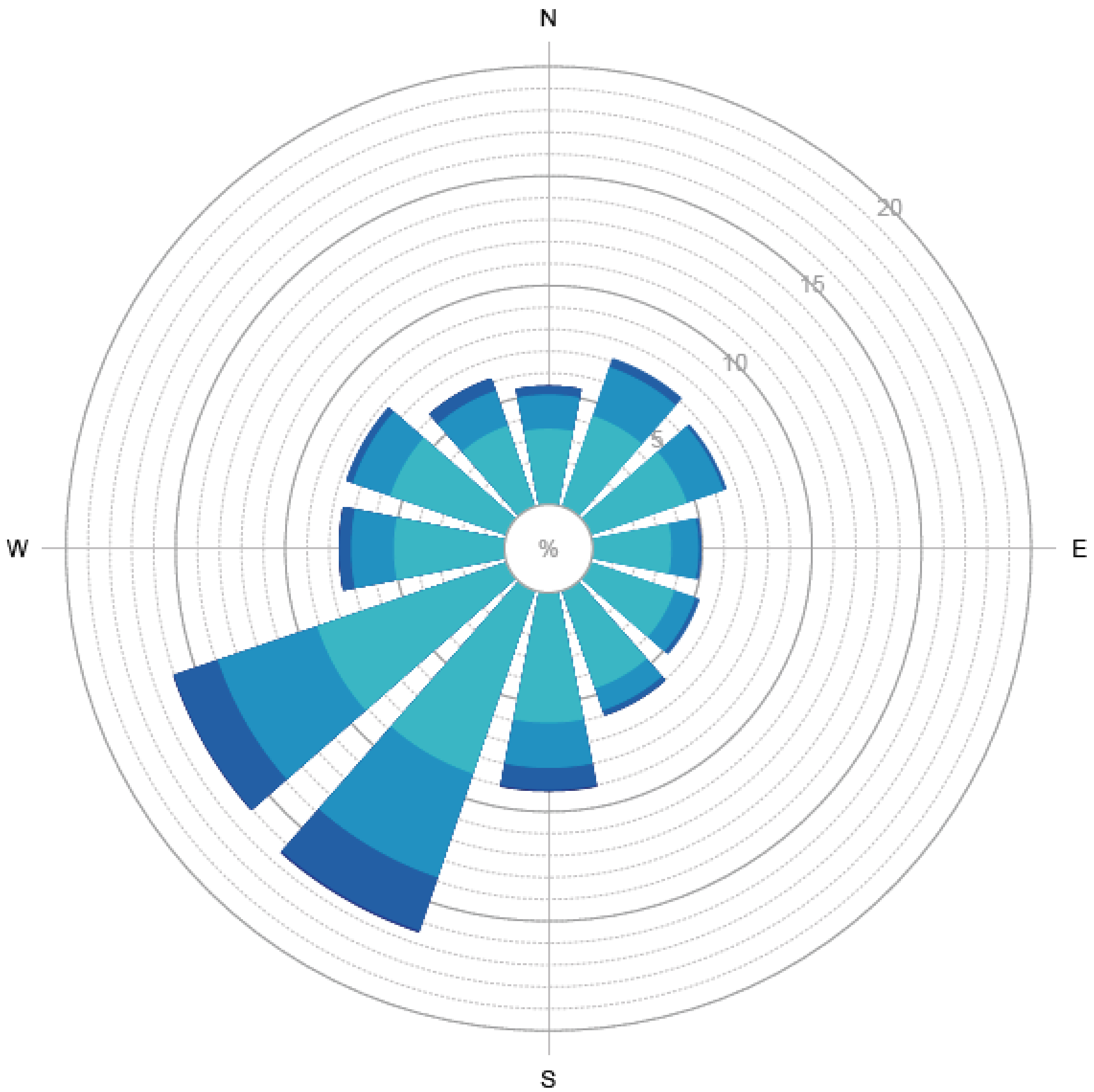

Figure 4 - Manston Wind Rose

The wind rose divides wind into 30° sections, and further subdivides the wind to indicate what percentage of the time it is within speed parameters, 1-10kts, 11-16kts, 17-27kts and 28-33kts.

1.6.3 Methodology and Assumptions

Wind speed and direction is in a state of near continuous change and it would be very difficult to assess raw wind data. For the purposes of analysis each wind rose section (a 30° wedge), is considered to be equivalent to all the wind being focussed through the centre of the section. For example, wind that is in the N section refers to wind in the direction 345° to 015°, however it is considered to be focussed in one direction as shown in Figure 5.

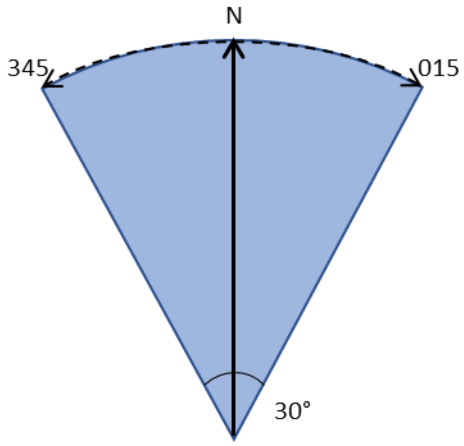

Figure 5 – Averaged Wind Range

In the same way as the wind direction, an assumption must be made about the wind speed. The Met Office data separates wind data into categories 1-10kts, 11-16kts, 17-27kts and 28-33kts, however the data gives no indication of how the wind speed is distributed within the category. To simplify the analysis, an assumption has been made that the wind speed distribution within each category is equivalent to the average wind speed value within that category. The wind speed used for each category is summarised in Table 3 below.

Wind Speed Category	Wind Speed Used for Analysis
1-10kts	5.5kts
11-16kts	13.5kts
17-27kts	22kts
27-33kts	30.5kts

Table 3 - Wind Speeds used in calculations

The wind rose data was analysed to determine the percentage of time that the wind at Manston is within each wind speed category. The results are summarised in Table 4 below.

Wind Speed	Wind Direction											
	000	030	060	090	120	150	180	210	240	270	300	330
1-10kts	3.42	4.34	4.61	3.55	3.95	4.74	5.92	8.82	9.08	5.00	5.53	3.95

Wind Speed	Wind Direction											
	000	030	060	090	120	150	180	210	240	270	300	330
11-16kts	1.58	2.37	1.71	1.32	1.05	1.05	2.11	5.00	4.74	2.11	1.84	1.71
17-27kts	0.26	0.39	0.13	0.13	0.26	0.26	1.05	2.63	2.11	0.53	0.39	0.53
28-33kts	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.00	0.00	0.00	0.00	0.00

Table 4 - Percentage of time wind is at given speed and direction

The original Met Office data states that the wind at Manston is idle for 0.1% of the time, so the data in Table 4 above should add up to 99.9%. The percentages total 98.29% due to rounding errors during analysis of the original data.

Using the average wind speed for each category, we can first determine what the tailwind component, near the runway, of each wind speed and direction is, and then use Table 4 to determine what percentage of the time the tailwind component is above a given level.

1.6.4 Landing on Runway 10 with a 5kts tailwind

The tailwind component for the wind speeds given in Table 3 for Runway 10 is shown in Table 5 below. When the tailwind component is greater than 5kts it has been highlighted red.

Wind Speed	Wind Direction											
	000	030	060	090	120	150	180	210	240	270	300	330
1-10kts	0.96	-1.88	-4.21	-5.42	-5.17	-3.54	-0.96	1.88	4.21	**5.42**	**5.17**	3.54
11-16kts	2.34	-4.62	-10.34	-13.29	-12.69	-8.68	-2.34	4.62	**10.34**	**13.29**	**12.69**	**8.68**
17-27kts	3.82	-7.52	-16.85	-21.67	-20.67	-14.14	-3.82	**7.52**	**16.85**	**21.67**	**20.67**	**14.14**
28-33kts	**5.30**	-10.43	-23.36	-30.04	-28.66	-19.61	-5.30	**10.43**	**23.36**	**30.04**	**28.66**	**19.61**

Table 5 - Tailwind components for Runway 10

Combining the data in Table 4 and Table 5 it can be shown that the tailwind component for landings on Runway 10 will be greater than 5kts for 27.12% of the time, as shown in Table 6 below (the sum of the filled grid boxes).

Wind Speed	Wind Direction											
	000	030	060	090	120	150	180	210	240	270	300	330
1-10kts										**5**	**5.53**	
11-16kts									**4.74**	**2.11**	**1.84**	**1.71**
17-27kts								**2.63**	**2.11**	**0.53**	**0.39**	**0.53**
28-33kts	**0.00**							**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 6 - Percentage of time tailwind is greater than 5kts on Runway 10

1.6.5 Take offs from Runway 28 with a 5kts tailwind

The tailwind component for the wind speeds given in Table 3 for Runway 28 is shown in Table 7 below. When the tailwind component is greater than 5kts it has been highlighted in green.

Wind Speed	Wind Direction											
	000	030	060	090	120	150	180	210	240	270	300	330
1-10kts	-0.96	1.88	4.21	5.42	5.17	3.54	0.96	-1.88	-4.21	-5.42	-5.17	-3.54
11-16kts	-2.34	4.62	10.34	13.29	12.69	8.68	2.34	-4.62	-10.34	-13.29	-12.69	-8.68
17-27kts	-3.82	7.52	16.85	21.67	20.67	14.14	3.82	-7.52	-16.85	-21.67	-20.67	-14.14
28-33kts	-5.30	10.43	23.36	30.04	28.66	19.61	5.30	-10.43	-23.36	-30.04	-28.66	-19.61

Table 7 - Tailwind components for runway 28

Combining the data in Table 4 and Table 7 it can be shown that the tailwind component for take-offs on Runway 28 will be greater than 5kts for 13.94% of the time, as shown in Table 8 (the sum of the filled grid boxes).

Wind Speed	Wind Direction											
	000	030	060	090	120	150	180	210	240	270	300	330
1-10kts				3.55	3.95							
11-16kts			1.71	1.32	1.05	1.05						
17-27kts		0.39	0.13	0.13	0.26	0.26						
28-33kts		0.00	0.00	0.00	0.00	0.07	0.07					

Table 8 - Percentage of time tailwind is greater than 5kts

1.6.6 Confirmation of Wind Assumptions

To test the importance of the assumptions made about average wind speed in Section 1.6.3 the calculations were rerun, changing the assumption of wind speed from the average of the range to a value at 75% of the wind categories as shown in Table 9 below:

Wind Speed Category	Wind Speed Used for Analysis
1-10kts	7.75kts
11-16kts	14.75kts
17-27kts	24.5kts
27-33kts	31.5kts

Table 9 - Wind Speed used for Analysis

Using the wind speeds in Table 9, the tailwind component would be unsuitable for landings on Runway 10 for 41.20%. Similarly, the tailwind component would be unsuitable for take-offs on runway 28 for 20.92%.

Changing the wind value increases the percentage of time Runway 10 would be unsuitable by approximately 14% and Runway 28 by 7%. This suggests that there is a high sensitivity to the wind speed assumption made and a more detailed study would be necessary to give a more accurate prediction of when the wind conditions make Mode 1 operations unfeasible but we estimate they would be within the range of 27 to 41% of the time.

1.7 Wet Runway Conditions

The European Joint Aviation Authorities (JAA) define a runway as wet when:

> *"The runway surface is covered with water or when there is sufficient moisture on the runway surface to cause it to appear reflective, but without significant areas of standing water"*

To determine how often the runway at Manston would be wet is very difficult based on historic Met data because there are many factors involved. Data can show how much rain fell over the course of one hour, but will not give any indication of the intensity of downpour. The intensity of the rainfall can be as important as the amount of rain that fell and the runway's capacity to drain will also have a big impact on how often a runway will be considered wet. For example, there could be a large total amount of rainfall on a given day, but that amount fell over the course of the whole day, so the runway's drainage was able to manage the volume, stopping the runway from ever becoming wet. On the other hand, a brief thunderstorm could result in less total rainfall but produce so much rainfall in a short period of time that the runway drainage could not cope, resulting in a wet runway.

1.7.1 Historic Rainfall Data

To determine how often a wet runway would preclude Mode 1 operations, assumptions must be made on when the historic Met data denotes that the runway is wet. The data used for this analysis details the total rainfall per hour at Manston for the year 2016 as shown in Figure 6 below:

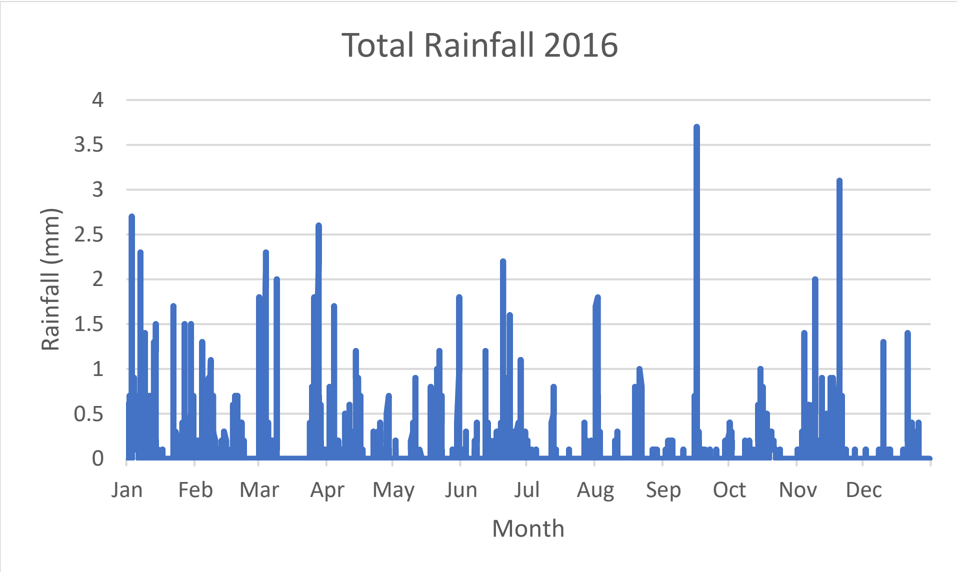

Figure 6 - Bar Chart of Manston Total Rainfall 2016

For the purposes of this report the level of rainfall required to make the runway wet needs to be defined in terms that align with the data. The Manston runway would be deemed to be wet if the amount of rainfall is equal to 2mm in the hour chosen and the preceding hour combined. By stipulating that the rainfall total is dependent on the previous hour, and using the Figure 6 data, allows for the possibility that a wet runway can be caused by an intense downpour or a more prolonged albeit less intense rain event. This does not consider any other weather conditions including temperature or wind conditions that would have an effect on the speed at which a runway is able to dry.

Using this as the definition for a wet runway indicates that there would be a total of 109 hours over 2016 in which the runway would be considered wet, as shown in Figure 7 below. 109 hours is equivalent to 1.24% of the year 2016, so Mode 1 would be unfeasible due to the runway being wet for 1.24% of the time. In discussion with operational experts this figure seems to be lower than expected, and it was felt that the correct figure would most likely be in the region of 1-5%.

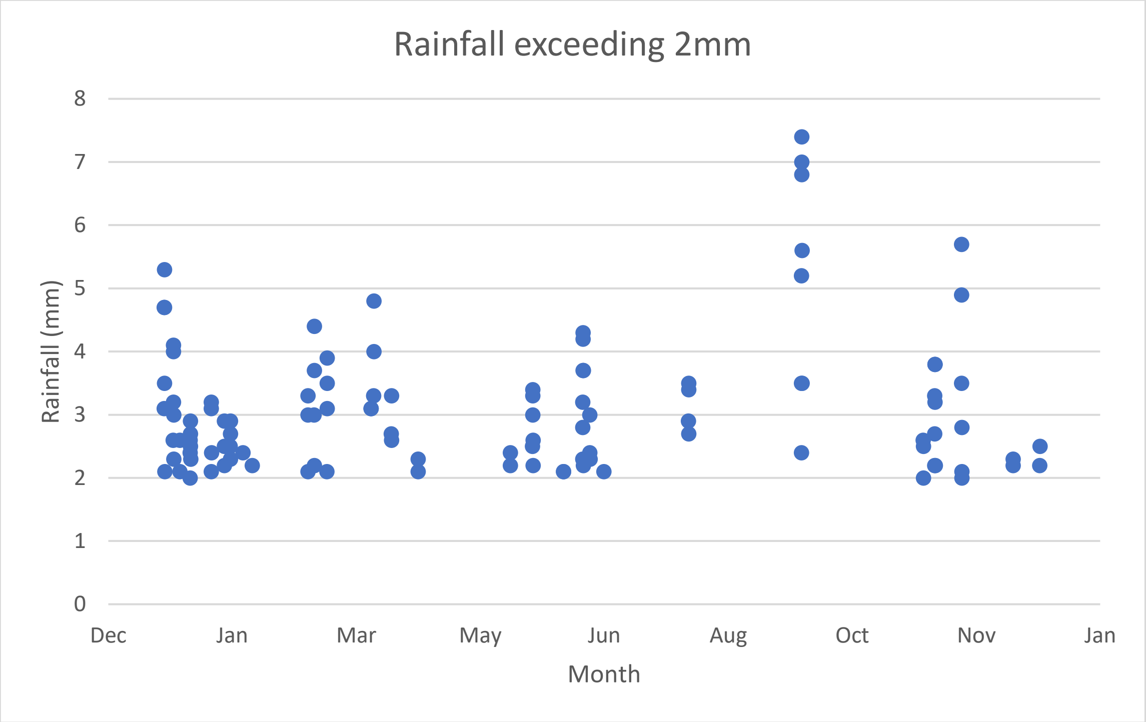

Figure 7 - Graph showing hours where rainfall exceeds 2mm

1.8 Reverse Thrust

Figure 8 - Pivoting-door thrust reversal on an A340-300

Reverse thrust is one of the major causes of noise for aircraft on the ground. It is used as a method of slowing down an aircraft, once landed, by temporarily diverting the aircraft engine's thrust so that it is directed forwards, rather than backwards. One method of noise mitigation used at an airport is to have a policy to discourage the use of reverse thrust. On dry runways the operational impact of such a policy is not very significant; however, on wet or contaminated runways the reverse thrust is more critical to decelerating the aircraft as the wheel brakes are less effective.

Many airports operate a reverse thrust minimisation policy. Usually the policy states that to minimise the disturbance in areas adjacent to the aerodrome, captains are requested to avoid the use of reverse thrust after landing, consistent with safe operation of the aircraft, between specified timeframes, most usually at night. To determine whether a similar policy can be utilised at Manston Airport, this report will examine if a reverse thrust policy could be instigated, by a comparison of the landing lengths required for different aircraft types, and under what conditions it should be utilised.

Generally speaking aircraft operations do not take account of the use of reverse thrust for landing calculations for dry runways. It can therefore be assumed that if an aircraft operator calculates that the aircraft can be landed on a dry runway then it can be done, under normal circumstances, without the use of reverse thrust. For runways that are wet or contaminated (standing water/snow/slush) then it is more likely, or even essential, to use reverse thrust on landing. Landing on a wet or contaminated runway with a tailwind will increase the likely use of reverse thrust or even preclude a landing on safety grounds. Based on these safety reasons and the extra noise for nearby residents, tailwind landings on wet runways will not be considered. In summary, on dry runways reverse thrust should not need to be used even with the tailwinds and on wet runways the use of reverse thrust would be required (or at least planned to be used), but minimised by landing into wind.

1.8.1 Effect of Tailwind on Landing Length Required

Calculating the effect of tailwind on required landing length is complex and for simplicity a predetermined factor is often used. The Flight Safety Foundation's Approach and Landing Accident Reduction toolkit[1] recommends using a factor of 1.2 for tailwinds up to 10kts, and this factor will be used for the purposes of this report.

To determine whether reverse thrust is likely to be needed on landing at Manston Airport the runway length was compared to the landing length required for a selection of aircraft types, likely to use the airport, at 80% of their Maximum Landing Weight (MLW), in calm conditions and with a tailwind of 5kts or less. The results are shown in Table 10 below:

[1] www.skybrary.aero/bookshelf/books/867.pdf

Aircraft	80% Maximum Landing Weight (kg)	Runway Length Required (m)[2]	Distance remaining from full runway length in dry conditions	Distance remaining from full runway length with a tailwind
Boeing 747-300	228,560	1,800	952	592
Boeing 747-400 Freighter	241,674	1,850	902	532
Airbus A380-800F	316,000	1,650	1,102	772
Airbus A330-300	148,000	1,370	1,382	1108
Bombardier CRJ900	26,672	1,450	1,302	1012
Boeing 777-200ER	178,534	1,400	1,352	1072
Boeing 767-300ER	116,120	1,450	1,302	1012
Boeing 737-400	44,996	1,400	1,352	1072
Airbus A319-100	50,240	1,100	1,652	1,212
Airbus A320-200	51,600	1,150	1,602	1,142
Embraer ERJ190	34,400	1,100	1,652	1,432
Bombardier Dash 8 Q400	23,223	1,000	1,752	1552

Table 10 - Comparison of landing distance required at 80% MLW

[2] This data is taken from the Airport Planning Manuals for each aircraft type

1.8.2 Reverse Thrust Minimisation Policy

Whilst Table 10 indicates that it is theoretically possible to land on a dry runway at Manston Airport with a tailwind of up to 5kts without the use of reverse thrust, it is important to note that this table gives the theoretical distances with no other external factors affecting landing characteristics. If the runway was wet the landing lengths required would be greatly increased and reverse thrust may be necessary. However, if the runway is wet then the preferential runway strategy described in Section 1.4 would mean that the in-to-wind runway was in use which would limit the need for reverse thrust. As a result, Manston Airport could instigate a policy whereby reverse thrust should be kept to a minimum at all times, and only used on a dry runway for safety reasons.

1.9 AFW Data

AFW analysed preferential runway data for night flying operations. The analysis looked at 8 aircraft movements in different runway configurations. The data is shown in Table 11 below:

Preference	Sleep Disturbance	No of people adversely affected by aircraft noise	No of people significantly affected by aircraft noise
4 departures and 4 arrivals	100	100	100
2 departures on RW10, 2 departures on RW28 and 4 arrivals on RW10	107	107 (5,668)	168 (10,007)
4 departures on RW28 and 4 arrivals on RW10	64	59 (-34,342)	126 (3,758)
4 departures on RW28, 2 arrivals on RW10 and 2 arrivals on RW28	95	93 (-5,836)	78 (-3,280)
4 departures on RW10 and 4 arrivals on RW28	81	64 (-28,447)	132 (4,643)

Table 11 - Percentage of baseline levels for night time preferential runway options

The data in Table 11 supports the preferential runway strategy described in Section 1.4. When all departures are on Runway 28, and all landings on Runway 10, there is a significant reduction in sleep disturbance and the number of people adversely affected by aircraft noise.

1.10 Conclusion

For a preferential runway strategy to be effective, Manston Airport would maximise the use of Mode 1 operations, which are landings on Runway 10, and take-offs from Runway 28.

Mode 1 is limited by the movement rate, and by the requirement to use the in to wind runway in wet or contaminated runway conditions

It was determined that Mode 1 operations would have to cease if the planned movement rate exceeded 5 movements per hour. Beyond this level, single direction runway operations would have to take effect to facilitate a higher movement rate regardless of favourable, to Mode 1 operations, prevailing weather conditions.

The tailwind component was assessed to be outside of acceptable safe limits for landings on runway 10 for 27.12%, of the time however it was assessed that this value is highly sensitive to the assumptions made about the average of wind speed within a wind speed category and more analysis would be of value.

The tailwind component was also assessed to be outside of acceptable safe limits for take-offs from runway 28 for 13.94% of the time.

A review of the rainfall data for 2016 revealed that the runway was wet (using the definition given in this report), for 1.24% of the time, however in discussions with operational experts it was determined that this calculation could be too low. Following review, it was determined that the percentage of time a runway is wet would be somewhere between 1 – 5%. Even at the highest end of this estimation this is not a significant factor in determining Mode 1 operations.

The preferential runway strategy is dependent on the movement rate necessary at Manston Airport. The percentage of time the three Modes described in Section 1.4 can be used is shown in Table 12.

	Movement Rate less than or equal to 5 moves per hour	**Movement Rate greater than 5 moves per hour**
Mode 1	53.9%	0%
Mode 2	32.1%	79.4%
Mode 3	12.2%	18.9%

Table 12 - Percentage of time Modes can be used

These results would indicate that Mode 1 operations would be achievable for at least 53.9% of the time. This value could be slightly higher however depending on the extent of the tailwind and wet runway limiting factors overlap.

The results above indicate that for the majority of the time Mode 1 could be utilised as a part of a noise mitigation strategy at Manston Airport based on prevailing weather conditions. However, whilst the weather conditions may fluctuate it is likely that the trends identified will remain broadly similar, so it will be more likely that the limiting factor to a preferential runway strategy will be the operational requirement to increase the movement rate. Whilst development of taxiway infrastructure may increase the potential movement rate, this increase will only be marginal when compared to the increase facilitated by adopting a single direction runway operation.