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OPERATIONAL SAFETY CASE

FACILITIES AND PROCEDURES FOR THE HANDLING OF AIRBUS A380 SCHEDULED SERVICES

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DISTRIBUTION

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REFERENCE DOCUMENTS

CAP 168	Licensing of Aerodromes
NOTAL 2/2003	Interim arrangements for the operation of Airbus A380
AACG Common Agreement Document 2002	Study into the compatibility of A380 at airports
ICAO Annex 14	Aerodromes, Volume 1 Aerodrome Design and Operations
ICAO Aerodrome Design Manual	Part 2, Taxiways, Aprons and Holding Bays
Manchester Airport	Aerodrome Manual 2010 v1.0
Manchester Airport	Emergency Orders 2010

PURPOSE OF DOCUMENT

The Aerodrome Licence, Condition 3 and CAP 729 (Guidance on Aerodrome Development Procedures) require that aerodrome operators inform and consult with the Civil Aviation Authority regarding any proposed development affecting the physical characteristics of the aerodrome or having other significant operational implications.

The purpose of this document is:

a. To satisfy the above requirements

b. To set out the scope of works and objectives of an aerodrome development proposal

c. To explain how the proposal will achieve its objectives whilst meeting regulatory requirements

d. To offer documented assurance that the development proposal has been assessed for its safety implications, both during the project and upon introduction into service

e. To provide information and guidance to those involved in the project

1.0 BACKGROUND

1.1 Manchester Airport has since October 2008 been available as a Diversion Alternate aerodrome for Airbus A380 flights diverted from other airports. In order to attain this status certain infrastructure changes and operating procedures were put in place. These are set out in the document Operational Requirement & Safety Statement 'A380 Diversion Alternate version 2.1'.

1.2 It was always envisaged that at some time there would be a commercial demand to operate A380s into Manchester on regular scheduled services. Manchester Airport now intends to provide facilities and procedures on a limited scale to support the introduction of daily scheduled services by Emirates Airlines on 1st September 2010.

1.3. Although to date no A380 aircraft has operated through Manchester the Airport has significant experience of ad hoc operations by Code F aircraft, principally the Antonov AN-124. Although not as large as an A380 the AN124 still requires some special arrangements to be in place in order to ensure its safe passage through the airport. These procedures are published in the Aerodrome Manual via Airport Standing Instruction 2V.

1.4. An assessment has been made of the present infrastructure against the requirements for operations of the A380 as set out in CAP 168. See paragraph 5.0.

1.5 This document will set out the findings of this assessment and explain how Manchester Airport intends to safely handle regular scheduled services by A380 aircraft.

2.0 DEVELOPMENT OBJECTIVE

2.1 The objective of the project is to permit regular scheduled passenger services by A380 aircraft through Manchester. The facilities and procedures are designed to enable A380 flights to operate with as few differences as possible to existing Code E operations, although owing to the large size of the A380 some special procedures and restrictions will apply.

2.2 The frequency of A380 operations through Manchester will initially be one landing and take-off per day, and unlikely to exceed three per day by 2015. The exception to this will be occasional diverted flights. Any sustained increase in frequency of A380 flights beyond this will trigger a review of infrastructure and procedures, and may require additional provision to be made.

3.0 PROJECT PLANNING & CONSTRAINTS

3.1 Project planning has been conducted through a variety of development meetings involving MA Operations & Fire, MA Airfield Strategy & Compliance, airline flight operations departments and National Air Traffic Services. Particular and specific input has been made by Emirates Airlines.

3.2. From the outset, this project does not set out to deliver full Code F compliance across all relevant airfield infrastructure within any specified timeframe. Such a requirement would render the project economically unviable.

3.3 There has been close consultation with Airbus Industrie, A380 operators' flight operations departments and senior pilots in order to verify and endorse the compatibility of the aircraft with the Manchester runway and taxiway system.

3.4 Key people from the project management team have attended industry forums and witnessed at first hand A380 ground operations at London Heathrow, Birmingham and Dubai airports. Learning points from these events have been applied to the planning for operations at Manchester.

4.0 SCOPE OF PROJECT

4.1 The main elements of the operational planning were these:

- An assessment of the airfield infrastructure at Manchester Airport and a comparison of the findings against the requirements for ICAO Code F characteristics. Where Code F requirements were not met in full, consideration was given to the interim arrangements for A380 operations as set out in AACG Common Agreement Document of 2002.
- Design modelling of the ground manoeuvring of an A380 aircraft around selected parts of the airport
- Production of an action plan of works to amend and upgrade elements of infrastructure where deficiencies have been identified.
- Developing a preferred system of operating, supported by risk assessment.

5.0 INFRASTRUCTURE ASSESSMENT

5.1. Methodology

Airfield infrastructure has been assessed principally by comparing the known existing characteristics against the various requirements, and identifying any areas requiring action. Existing characteristics are those recorded in the Aerodrome Manual, with detailed areas checked using AutoCAD and survey data.

5.2.1. Ground movement of an A380 aircraft around the preferred routes at Manchester Airport was modelled using the Savoy Auto-Track application in conjunction with an AutoCAD base plan of the airfield. This showed how the wingtips and the undercarriage of an A380 could be expected to behave when the nose gear was maintained over the centreline of the taxiway. From this work MA Airfield Planning was able to determine whether sufficient pavement width and object clearance was available, and to identify any areas in need to modification. The Airfield Policy & Planning Manager in the A380 Safety Assurance File holds these tracking drawings.

5.2.1. Ground manoeuvring has also been modelled by Emirates Airlines on a full-scale A380 simulator and using the same aerodrome data provided by Manchester Airport.

Airfield Characteristics

5.4. Runways

Both runways 05L-23R and 05R-23L comply with the AACG requirements, although not Code F in all respects. Characteristics of the two runways differ.

- Runway 05L-23R has a total paved width of 92 metres, comprising a 46m runway width plus paved shoulders of 23m each side.

- Runway 05R-23L has a total paved width of 60m comprising a 45m paved runway + 7.5m paved shoulder. Outside of this paved width there is a stabilised grass shoulder extending to the limit of the Cleared & Graded strip. The condition of the inner 7.5m of this outer shoulder has been examined by Emirates A380 Flight Operations experts and is considered suitable with respect to blast and erosion risks, subject to ongoing maintenance and inspection. This assessment has been endorsed by Airbus Industrie and is in line with latest CAA policy.

- Trials have been held to assess the ability of the stabilised outer shoulder to support a fire tender. The first trial was held in damp summer conditions and the shoulder successfully supported the vehicle. The second trial was held in extremely wet winter conditions. Most of the shoulder still supported the vehicle, however at some isolated points totalling 10% of the strip length, poor drainage caused the vehicle to bog down. Whilst an option, RFFS response to aircraft stopped on Runway 05L-23R is not dependent upon using the grass areas, quartering to the front and rear may be achieved by using the parallel taxiway and links and/or the perimeter road and access tracks. In this respect a response to an A380 is no different to a Boeing 747 or other Code E type where the wings extend to the edges of the pavement. In the first instance response would make use of paved accesses.

5.5 Runway / Taxiway separation, Runway Holding Positions

5.5.1 Taxiway Alpha centreline is offset from the centreline of Runway 05L-23R by a distance of between 185 and 213 metres. Along most of this length the distance exceeds the requirements of Code F. It is only at the extreme western end that the distance decreases to 185m, just 5m short of the Code F standard.

Taxiway Kilo centreline is offset from Runway 05L-23R by 195 metres, exceeding the requirements for Code F. No procedural interaction between the runway and taxiway is required.

Taxiway Juliet centreline is offset from Runway 05L-23R by 171 metres. This falls 19 metres short of the requirements of Code F (190 metres). This deficiency is examined under the Safety Assessment at paragraph 13.

Taxiway Victor is offset from Runway 05L-23R and Runway 05R-23L by 195 metres, which exceeds Code F requirements. No procedural interaction between the runways and this taxiway is required.

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5.5.2 Runway/Taxiway Holding Positions (RTHPs) presently range from between 90 metres and 137 metres from the adjacent runway centreline. The Code F minimum standard is 107.5m for an instrument runway. Manchester Airport is currently re-configuring all RTHPs to a distance of 137m, which will exceed the requirement, however not all of this work will be complete at the introduction of A380 operations. This risk will be considered in the Safety Assessment at paragraph 13.

5.6. Taxiways & Taxilanes

Taxiways available to A380 operations have been selected in accordance with their physical characteristics and location. All permitted A380 taxiways will meet Code F or at least AACG requirements. Objects such as signs are being relocated along these routes in order to ensure and obstacle free strip to the required width.

Vehicle access points along the A380 taxiway routes have the holding position (a white line with signage) located at least 49m (AACG) from the taxiway centreline and in most cases at 55m (Code F).

Two locations of restricted pavement width have been identified along A380 permitted routes These locations are at the intersection of Taxiway Alpha with Runway 05L/23R, and at the intersection of Taxiway Juliet with Runway 05L-23R. Whilst simulation modelling has shown that it is possible to safely manoeuvre using over-steering techniques, aided by on-board cameras, additional pavement width is to be constructed at these two locations in order to ensure a greater margin of safety and compliance with CAP 168 wheel to pavement edge characteristics. A380 permitted taxiways are shown at Appendix 2 & 3

5.7 Taxiway/Taxiway separation

There are two locations where the centreline-to-centreline separation between an A380 taxiway route and an adjacent taxiway does not meet the requirements of Code F. These are locations are:

- between Taxiway Juliet (J4-J6) and taxiway Golf, where the distance is 80 metres)
- between Taxiway Kilo and Taxiway Bravo (B3-B4 only), where the distance converges from 90 metres to less than 70 metres.

This non-compliance will be managed procedurally, pending longer-term re-alignment. MATS Pt.2 will prohibit use of Taxiway Golf and Taxiway Bravo (B3-B4) whilst an A380 is using Taxiway Juliet (J4-J6) and Taxiway Kilo respectively.

5.8. Pavement strength (PCN) and structural strength

5.8.1. PCN for Runway 05L-23R is 92 F/C/W/T, and for Runway 05R-23L is 79 F/C/W/T, both adequate for A380 operations at maximum weight.

5.8.2. Manchester taxiways / taxilanes are constructed with sub-grade 'C' with either flexible or rigid surface. A fully loaded A380 has an Aircraft Classification Number (ACN) in the range of 75-80 for flexible pavement, and 76-88 for rigid pavement. These figures can be considered to be high for the purposes of this assessment because the proposed A380 operations through Manchester will be substantially below MTOW, at around 470 tonnes, equating to an ACN in the range 60-62 for flexible pavements with a low-strength sub-grade. Both Runways meet the required maximum PCN. All taxilanes meet the required maximum PCN. A deficiency has been identified in the following locations along A380 routes:

Taxiway Alpha between AE and B: PCN 66 F/C/W/T with isolated areas 46 F/C/W/T
Taxiway Alpha between B and C: PCN 72 R/C/W/T.
Taxiway Juliet J3-J6 : PCN 72 F/C/W/T

The section of taxiway Alpha between Link Bravo and Link Alpha-Echo is aging and showing signs of structural distress in a number of locations. A recent engineering assessment has estimated the pavement strength to be 66/F/C/W/T, reducing to 46/F/C/W/T at a number of isolated locations along the taxiway. This is lower than most other major taxiways on the airport that have PCNs in the range of 72-107. The risk arising from this is discussed in the Safety Assessment at paragraph 13.

5.8.3. Consulting Engineers Scott Wilson & Partners have carried out an assessment of the 1969 bridge structure that carries Runway 05L-23R and Taxiway Alpha over the A538 Trunk Road. They reported that it is capable of supporting a fully laden A380 (569 tonnes) without modification. A380s using Manchester on regular scheduled services are expected to have a typical TOW of around 450 tonnes.

5.9. Parking Stands

The primary parking stand for scheduled A380 operations is Stand 12. This stand has been purpose-built to serve A380 turnarounds with full facilities and generous space for ground handling activities. Facilities comprise aerobridge service to main and upper decks (two bridges), hydrant fuelling, fixed electrical ground power, SafeDock VDGS, and high specification apron floodlighting.

Additionally, Stand 62 is available for A380 parking and turnaround, but because this stand has less space and fewer facilities it will serve primarily as a back-up stand and for diverted flights.

6.0 SAFETY MANAGEMENT

6.1 Key Personnel & Responsibilities

Responsibility	Name	Contact number
MA Airfield Policy & Planning	Rory McLoughlin	0161 489 5035
MA Airfield Operations & Fire	Chris Formby	0161 489 3716
MA Emergency Planning	Anne McPhie	0161 489 2319
NATS ATC	Paul Jones / Chris Sheppard	0161 499 5316
ATC Engineering	Kevin Nolan	0161 499 5205

6.2. Operational Procedures

Procedures for the operation and handling of A380 aircraft at Manchester Airport have been produced in full cognizance of the limitations of the present airfield infrastructure. In most cases these limitations are addressed by the use of specified taxiway routings, under escort, supported by procedural segregation of the aircraft from other airport operations. It is accepted that this will necessarily create some delay to normal operations, but will be only occasional in frequency. The procedures are contained within an expanded Airport Standing Instruction (ASI) 2V, supplemented by Local Operating Instructions used by Airfield Operations, and MATS Part 2, used by ATC. ASI 2V and AOP XXX are included here at Appendix 1

6.3. Low Visibility Procedures (LVP)

A380 flights may use the airport in much the same manner as other aircraft types in LVP conditions, however due to the enlarged ILS Critical and Sensitive Areas applying when an A380 is taxiing near the runway, some special procedures will apply. These are listed at in the table of procedural constraints at Appendix 4. They will be actioned via the NATS Supplementary Instruction on A380 operations, and in the corresponding Manchester Airport AOP.

7.0 AIRCRAFT GROUND MOVEMENT - TAXIWAY RESTRICTIONS

7.1. Movement of A380 aircraft on the ground is restricted to specific routes that are identified and illustrated in a matrix at Appendix 4. Most restrictions relate to the availability of taxiway strip and clearance from fixed obstacles. Priority is given to using Code F compliant routes, the remaining sections being those meeting AACG requirements with regard to pavement width, wingtip to obstacle clearance, as well as jet blast considerations.

7.2 On occasions where more than one A380 is due to be on the ground simultaneously, only one may be manoeuvring at any time, the other being parked at a stand.

8.0 AERODROME SAFEGUARDING

8.1 Assessment and Treatment of Obstacles

8.1.1. The A380 has a tail height of 24 metres, at least 4 metres higher than any current aircraft type. The impact of the tail height upon the Obstacle Limitation Surfaces has been assessed. The principle considerations are:

- When parked at Stand 12 the A380 tail sits beneath the Inner Horizontal Surface. There is no infringement, with a clearance of 6.27 metres.

- When taxiing, aircraft are considered to be temporary transient obstacles that will necessarily infringe the Transitional Surface but must remain clear of the Obstacle Free Zone (OFZ). Calculations for OFZ dimensions have been based upon applying a Code F OFZ when the runway is being used by an A380, and a Code E OFZ at all other times. Runway holding positions have been assigned to ensure that OFZ will not be infringed during any A380 operations. The relevant procedures are found in MATS, Pt. 2 and ASI 2V.

8.2 Technical (radiating navigational aids)

8.2.1. Instrument Landing Systems (ILS)

It is understood from studies carried out at other airports that the manoeuvring of an A380 on the ground can have an adverse effect upon Localiser signals over a wider area than for existing large types such as the B747. Modelling and experience at other airports suggests that the Localiser Sensitive Area (LSA) may need to be extended out to 190 metres from the runway centreline, and the Critical Area to 1000m along the runway from the Localiser. It is also apparent that local characteristics such as terrain and buildings can make the effects differ between one airport site and another. As part of a project to install new ILS to Runway 05L-23R THALES plc commissioned the modelling of a Localiser Sensitive Area applicable to the THALES 420 ILS (Category 3B) with 20 element LPD array. The study, undertaken by NAVCOM, suggested that the ILS at Manchester would be less affected by A380 ground manoeuvring than is, for example, London Heathrow, where there is a higher density of building development surrounding the site. It concludes that the LSA for Runway 05L-23R may be no greater than 137.5m wide (each side of runway centreline) when an A380 is taxiing and manoeuvring alongside. This will need to be proven in operational experience.

8.2.2 Further modelling work has been undertaken by NATS to verify these findings. NATS have recommended the application of a Dynamic Localiser Sensitive Area (DLSA) whenever an A380 is taxiing at Manchester during CAT II and III operations. The dimensions of the DLSA are greater than for B747 operations, and have been used to determine certain clearance limits for A380s during LVP.

8.2.3. As well as a DLSA there are enlarged Critical Areas which must be applied to A380 ground manoeuvring at all times, not just in LVP. The Critical Areas extend

some 1000 metres from the Localisers and require A380s to be clear in order to safeguard integrity of ILS signals. These procedures are covered in MATS Part 2. The procedures utilise Intermediate Taxiway Holding Position D3 (240 metres from 05L-23R centreline) as the defining point of the DLSA for the A380.

8.2.5. Area Primary and Secondary Radar

Manchester Airport has an on-airport combined Primary and Secondary Surveillance Radar comprising an array mounted atop a 20 metre tubular tower within the airport boundary. The tower location is some 155 metres to the north of Taxiway Alpha centreline, a route to be used by A380 aircraft. Given the tail height of an A380 and the relative proximity of the taxiway to the antenna site, a study has been undertaken into any possible effects upon the radar when an A380 passes or is stationary in the vicinity.

NATS assessment reported that "with respect to the Watchman safeguarding slopes, when an A380 is on the taxi-way the tip of its tail fin will penetrate the safeguarding slope by about 0.5m at the closest point on the taxi-way (150m in distance) and in a direction that would not be of concern for any aircraft on approach or take off. As this is only a transient shadowing, I do not foresee that there would be any technical safeguarding objection to this".

9.0 SIGNAGE PLAN & PAVEMENT MARKINGS

9.1 No new aerodrome signage and markings are necessary for the proposed operation. Existing taxiway signage along Primary and Secondary A380 routes has been relocated to comply with Code F strip requirements.

10.0 EMERGENCY PROCEDURES

10.1 The main focus of planning for RFFS response has been the ability to provide Category 10. Detailed procedures for this provision are contained within the MA Fire Service Safety Case for Category 10 Operations. This has been submitted separately to the CAA Aerodrome Standards Department.

10.2. The Emergency Procedures for Aircraft Accidents/Incidents are contained within the Emergency Orders (Aerodrome Manual Part 3). The emergency response for A380 operations was reviewed in a tabletop exercise. The exercise concluded that that the existing emergency response plans were capable of accommodating the A380. This included a review of external agencies Pre-Determined Attendance (PDA), Passenger Evacuation Management Process (PEMS), transport from the incident scene to reception centres, medical facilities including body holding areas and reception centres.

10.3 The plan for recovery of an A380 aircraft was also reviewed in the tabletop exercise, and arrangements agreed with the Airport's aircraft recovery company – including access to IATA equipment pool.

11.0 ENGINE GROUND RUNNING / COMPASS SWING

11.1 In the event of an A380 requiring to carry out engine ground running above idle power, the Engine Test Bay cannot be used as it has a design maximum aircraft size of B747-400. Consideration has been given to the open field areas where such testing may take place safely with regard to jet blast and ingestion risks. The only suitable location is for such tests to take place with the aircraft aligned on the centreline of Runway 05L-23R, at one end or the other, with the aircraft facing the direction offering the greatest headwind component. Operations on this runway will normally be suspended for the duration of the test, although consideration may be given to allowing aircraft to depart away from the test area, using a suitable intersection. ASI 2J and 2U set out the Standing Instructions applying to such operations.

12.0 AIRSPACE ISSUES

12.1 There are no specific airspace issues arising from the use of Manchester Airport by A380 flights. The required vortex separation for aircraft in trail will be applied by Manchester ATC in accordance with the MATS, Pt. 1.

12.2. Emirates Airlines have confirmed that A380s will be able to fly all published Instrument Flight Procedures and Missed Approaches applicable to Manchester.

13.0 AIR TRAFFIC CONTROL

13.1 As far as possible A380 movements will be handled using the same procedures as for other large aircraft such as the B747 that regularly operate through Manchester. Where differing or additional procedures are required specifically for the A380, these will be included in the Manual of Air Traffic Services, Part 2. These procedures will be aligned with those set out in the Aerodrome Manual, ASI 2V to take account of constraints and safety requirements arising from aerodrome characteristics and operating environment.

13.2 No additional ATC equipment or resources are required for the introduction of A380 services.

14.0 SNOW PLAN

14.1 The Manchester Airport Snow Plan will amend snow bank profiles on runways and taxiways will meetA380 standards as given in CAP 168, Ch. 3, 11.2.5.2.

14.2. Priority 1 snow-clearance routes will include all Primary A380 taxiways.

15.0 SAFETY ASSESSMENT

15.1 General considerations
Manchester Airport has many years of experience with regular scheduled operations by large transport aircraft including the Boeing 747-400 and Boeing 777-300ER. There are also regular, albeit infrequent, operations by the Code F Antonov AN-124 freighter.

15.2. Manchester Airport was a contributor and signatory to the AACG 2002 Common Document and therefore accepts the generic safety arguments contained within that document relating to operations by A380s at aerodromes where some characteristics do not meet full Code F requirements.

15.3. Methodology

15.3.1 Risks have been assessed through both the MA Operational Risk Assessment process, and also by NATS through their own internal HAZOP process. Both exercises were carried out by joint MA/NATS panels to ensure a 'joined-up' approach. The outcomes of the NATS process will be presented through the appropriate ATS regulatory channels.

15.4. Specific hazards

The MA Operational Risk Assessment was initiated at an Operational Safety Workshop held on 10th February 2010. Further joint workshops were held on 9th and 10th June. 12 specific hazards were identified:

- Jet blast erosion / ingestion due to soft outer shoulder on Runway 05R-23L
- Interference with ILS signals on both runways
- Interference with primary & secondary radar
- Jet blast affecting apron activities, signage, and ground equipment
- Centreline-centreline separation on certain taxiway routes does not meet Code F.
- Effect of existing Aerodrome Licence Variations on A380
- A380 using a prohibited taxiway
- Runway excursions involving an A380
- Light aircraft aprons alongside A380 routes (potential for taxiway obstacle)
- Incorrect parking of aircraft at Stand 47 (potential for taxiway obstacle)
- Multiple A380s on the airport
- Reduced strength pavement on Taxiway Alpha.

The risks arising from these hazards have all been documented through the MA Operational Risk Assessment process (ORA 1/2010). An outline of the rationale applying to management of the above risks is given below:

Risk 1 : Jet blast erosion / ingestion due to soft outer shoulder on Runway 05R-23L

A description of the characteristics of this shoulder is given at paragraph 5.4. The outboard engines on the A380 run close to the edge of a 60m-wide pavement, giving a potentially greater risk of FOD ingestion or generation.

Safety Statement: Experience with A380s using similar runways, including certification testing, has shown that such operations can be sustained safely provided that the integrity of the shoulder is regular monitored for signs of deterioration, and that remedial action is taken promptly should any defects be found. The manufacturer has now certificated the aircraft to operate from runways with a total paved width of as little as 58 metres, without special procedures. The composition of the outer shoulder is dense grass, with any potential loose material limited to lean-mix concrete aggregate surrounding buried structures. This aggregate is maintained in a bound-in condition by regular application of slurry. Manchester Airport will ensure that the outer shoulder is inspected before and immediately after any A380 departure. The frequency of these inspections will be reviewed once a reasonable period of operating experience has been accrued. If required, remedial actions such as sweeping or turfing will be carried out as a matter of priority. A380s will not be permitted to depart from this runway should the condition of the shoulder be considered unsuitable. This assessment may be made by any one of the following Accountable persons: Airfield Duty Manager, Airfield Operations Manager, Head of External Engineering.

Risk 2: Interference with ILS signals on both runways

It is known that A380s manoeuvring close to runways can cause deflections of the Localiser signal. The actual effects vary with the location, environs and the type of equipment installed.

Safety Statement: The effects may be anticipated to a greater extent by technical modelling. This has been undertaken for Manchester both by NATS and by Thales plc. The outcomes of this work have determined that the effects are acceptable during operations down to CAT I minima. To ensure that CAT II and III operations are not compromised, A380 ground movements will be subject some restrictions in order to ensure integrity of the Localiser signals whenever the airport is operating in LVP conditions. A380s will be held at a suitable distance from the runway centreline, usually 190m of more, until a gap in arriving traffic is created by ATC to enable the A380 to taxi through and beyond the area of influence, be this after arriving or on departure.

Risk 3: Interference with primary & secondary radar

The large tailfin of an A380 will pass close to a Primary and Secondary radar head on the airfield. There is potential for the tailfin to obstruct or deflect radar signals and returns.

Safety Statement: The radar site is owned and operated by NATS, who have assessed the potential impact from A380 operations. The tail fin penetrates the safeguarded by 0.5m in an area not of concern for aircraft on approach or take-off. NATS therefore have no safeguarding objections.

Risk 4: Jet blast affecting apron activities, signage, and ground equipment.

The A380 has four large jet engines. Whereas the power rating of these engines is less than some other large aircraft using Manchester, the mounting of the outboard engines does bring jet plumes closer to certain airfield installations and activities.

Safety Statement: Jet blast plume profiles have been modelled and the effects assessed. Along the primary taxiway routings and on/off stand manoeuvring no areas or installations will be subject to significant jet blast. Along A380 routings, signage has been located at the correct offset for Code F, and is mounted securely in concrete plinths. The exact effects will vary with conditions but are expected to be similar to a 30-knot gust of wind, an effect that is experienced naturally from time to time.

Risk 5: Centreline-centreline separation on certain taxiway routes does not meet Code F requirements.

There are two areas of the airfield where this occurs – taxiway Juliet/Golf, and taxiway Bravo/Kilo.

Safety Statement: In the case of Taxiway Juliet/Golf, where the centreline separation reduces to 68m minimum. The effect is reduced wingtip separation rather than any significant risk of collision, due to the Code D size limitation on Taxiway Golf and its normal maximum size aircraft being a B767. Procedures will require Taxiway Golf to be clear whilst an A380 uses taxiway Juliet, thus avoiding this potential conflict.

In the case of Taxiway Kilo/Bravo there is a converging separation with a risk of wingtip collision if a Code E aircraft were using Bravo. Procedures will require Taxiway Bravo (B3-B4) to be clear whilst an A380 uses taxiway Kilo, thus avoiding this conflict.

Risk 6: Effect of existing Aerodrome Licence Variations on A380.

Several Aerodrome Licence Variations apply at Manchester, where infrastructure does not fully meet ICAO requirements. Those which will be relevant to A380 operations are:

- Variations 1-6, obstacles.
- Variation 11, Taxiway Juliet separation from centreline of Runway 05L-23R reduces to 171 metres between J2 and J5
- Variation 12, Runway 05L-23R longitudinal slopes and sightlines.
- Variation 7, airside roadways within taxiway/taxilane strips.

Safety Statements:

- Obstacles: These are promulgated and taken account of in Instrument Flight Procedures.
- The reduction in separation between Taxiway Juliet and from Runway 05L-23R is some 19 metres less than prescribed. The effect of this reduction at a frequency of one or two events per day is considered to be incremental, and is accepted. It is preferable to accept this very small risk as an alternative to implementing further special procedures.
- Runway slopes and sightlines: These have no greater effect than on other aircraft types.
- Taxiway strips / roadways. A380 has little exposure to this due to limited areas of operation. A380 only encounters roadways abeam end of Pier A. Situation will be no worse than for most B747-400 at other points on the aerodrome, in terms of engine / wingtip proximity to road traffic.

Risk 7: A380 using a prohibited taxiway – collision with object/aircraft/vehicle. Inadequate pavement strength/ interference with ILS signals.

Safety Statement: A380 permitted routes will be clearly published on a separate chart in the UK AIP. There is only one airline operator of the type into Manchester at present and this operator provides A380 pilots with comprehensive operating instructions regarding A380 limitations, based upon information produced in consultation with the aerodrome operator. Notwithstanding this, a Follow-Me vehicle will lead all A380 movements on taxiways to the north of Runway 05L-23R, except during LVP when sequential (progressive) taxiway centreline lighting will guide the pilot along the authorised route. A Follow-Me vehicle will not be used for the southern side taxiways as there is little prospect of a pilot taking an incorrect route and no hazard arising should he do so.

Risk 8: Runway excursions involving an A380; runway overruns, effect of the large airframe upon likelihood and severity of a resulting collision with another aircraft.

In the event of an A380 exiting the side of a runway during the landing or take-off run, it could be argued that the larger airframe compared with Code E types (particularly wingspan) increases the likelihood of a resulting collision with another aircraft using the parallel taxiway. The same consideration applies should any aircraft exit a runway when an A380 is using the parallel taxiway. Regarding severity, an A380 might contain as many as 517 passengers plus crew, plus 100 tonnes of fuel, larger figures than for most other individual flights. An overrun of the runway pavement could involve the scale of severity above.

Safety statement: Whilst theoretically present, it is difficult to calculate the increased likelihood of collisions in these circumstances. The wingspan of an A380 reduces the available clearance from either the runway to an aircraft on the parallel taxiway, and vice versa, by just 7.5 metres as compared to the largest Code E aircraft. The difference in risk arising is therefore thought to be

incremental rather than by order of magnitude. Along much of the length of parallel taxiway the distance from the adjacent runway centreline actually exceeds Code F requirements (>190m). Where this distance is less than Code F, such as Taxiway Juliet (171m), procedural separation could be applied i.e. no landing or take-off whilst an A380 uses the relevant section of taxiway, or a restriction on aircraft size on the taxiway. However, this increases the overall complexity of procedure, adding to ATC workload and perhaps, as a result, introduce other unexpected risks. In coming to this conclusion, Manchester Airport has also taken into account that ICAO Annex 14 allows for aircraft to be held at a distance of 107.5 metres from the runway centreline at intermediate intersections along a runway whilst Code F operations take place in CAT I conditions. This distance is much less than would be the wingtip of a Code E aircraft on Taxiway Juliet, for instance. The comparative distance in this case would be 171-32.5 = 138.5m. Therefore no special measures will be taken in respect of this non-compliance, the risk is considered acceptable. In considering the overrun risk, RESAs at Manchester were extended in 2009 such that at all four ends the length is equal to or greater than the ICAO Recommendation of 240 metres. Given that the A380 is less demanding on runway lengths than existing large types the risk of overrun is considered to be very low, particularly in view of the low frequency of operation.

Risk 9 and Risk 10: taxiway obstacles arising due to light aircraft aprons alongside A380 routes or incorrect parking of aircraft at Stand 47.

Potential for loss of separation, or wingtip collision during taxi.

Safety Statement: All A380 taxi routes are set out to ensure at least the minimum AACG 49 metre taxiway centreline to object clearance. This gives a 9m buffer to allow for deviations and errors in parking of aircraft adjacent to the strip. Stand 47 has an additional 4-metre safety buffer between the tail of largest aircraft (A320) and the edge of the strip (apron roadway). Notwithstanding this, prior to each A380 taxi movement, the relevant areas will be checked by Airfield Operations staff to ensure the strip is obstacle free. The extent of strip is clearly indicated by ground markings. Furthermore, a Follow-Me vehicle will lead all A380 taxiing except during LVP when sequential (progressive) taxiway centreline lighting will guide the pilot along the authorised route.

Risk 11: Multiple A380s on the airport

The likelihood of there being more than one A380 on the airport at the same time is low; nevertheless it may happen, particularly should flights be diverted from other airports. Given the infrastructure limitations this could be demanding upon ATC and operational staff attention.

Safety Statement: Manchester will accept multiple A380 flights up to the maximum for which stands are available, currently two. Only one A380 will be permitted to be moving on the ground at any time.

Risk 12 : Reduced strength pavement on Taxiway Alpha.

The section of Taxiway Alpha between Link Bravo and Link Alpha-Echo is aging and showing signs of distress in a number of locations. A recent engineering assessment has estimated the pavement strength to be 66/F/C/W/T, reducing to 46/F/C/W/T at a number of isolated locations along the taxiway. This is lower than most other major taxiways on the airport that have PCNs in the range of 72-107.

Safety Statement: Daily scheduled services by A380s at Manchester will have a take-off weight no greater than 470 tonnes, substantially less than the aircraft's Maximum All-Up Weight of 569 tonnes. Using the Airbus ACN/PCN tables this results in a typical ACN of 60-62, within the assessed strength of this section of taxiway. Engineering opinion is that there is a negligible risk of a pavement failure of the type that would cause damage to the structure of an aircraft. Rather, the principle risk is from FOD damage / ingestion.

In order to manage and mitigate this risk, a series of regular pavement inspections have been instigated. A visual inspection is carried out at least once per days by Airfield Operations and these are supplemented by weekly engineering assessments. If serious surface defects are noted as a result of these inspections, remedial actions are taken. These can range from merely removing the loose debris to undertaking localized surface repairs. If there are any doubts about the integrity of the pavement surface, immediate steps are taken to close the section of taxiway pending further inspection or remedial action. This strategy for the continued safe management and operation of Taxiway Alpha has been in place for the past 12 months and is therefore is considered both appropriate and effective.

In the medium term there are plans to strengthen the taxiway. This will not only improve the PCN value but most importantly it will reduce the generation of FOD. In the longer term these are plans to fully re-construct the taxiway.

16.0 FUTURE DEVELOPMENTS

16.1. All future developments at Manchester Airport will be designed with due recognition of the need to ensure that A380 operations may be continued or enhanced both during and upon completion of the project. Major projects currently in planning are:

- Construction of a contingency ATC tower 2010-11
- Major refurbishment of Runway 05L-23R (re-surfacing and new AGL) 2010-2011.

17.0 PROMULGATION OF INFORMATION

17.1 The Manchester Airport Aerodrome Manual will be re-issued to include revised Airport Standing Instructions: 1A (Aircraft Engine Ground Running), 1B Aircraft Compass Calibration), 2Q Recovery of Disabled Aircraft), 2V (Very Large Aircraft), and 4G (Aircraft Washing), detailing the procedures and requirements likely to arise with regard to regular A380 operations into Manchester.

17.2 The UK AIP AGA entry (textual data and additional charts) will be amended to include information specifically relating to A380 operations at Manchester Airport, including a chart depicting the taxiway routings authorised for A380 movement.

Appendix 1 - Extract from Airport Standing Instruction 2V- Very Large Aircraft Operations.

Operations by Airbus A380 aircraft.

Manchester Airport is available to scheduled passenger operations using Airbus A380 aircraft. It is stressed that the airfield infrastructure currently at Manchester Airport does not in all respects comply with ICAO requirements for aircraft designated as Code F, although parts of the airfield are undergoing progressive upgrading to these standards. Where this is the case, facilities are provided on the basis of the 'Common Agreement Document 2002' produced by the A380 Airport Compatibility Group. In most respects the facilities offered for use by A380 are compliant with these. A full schedule of airfield characteristics assessed against Code F and AACG requirements is included in the Operational Safety Case for A380 Destination status, and approved by the UK CAA.

Owing to the present limitations in the aerodrome infrastructure, the operation of an A380 through Manchester Airport will be subject to certain restrictions and special procedures. Delays to A380s and other airport traffic are possible during ground movement between runway and parking stand.

4.1. Aerodrome availability and procedure overview

Facilities currently available for the A380 are limited and only two A380s may be accommodated on the ground at any one time.

An airline operator intending to divert an A380 into Manchester must notify the ATC Watch Manager and/or the Airfield Duty Manager either directly or via their handling agent. Notification at the earliest opportunity of the intention to divert will be beneficial in enabling advanced planning and will help to ensure that the aircraft is not unduly delayed upon arrival. Arrangements should be in place with a nominated Handling Agent to provide all required ground support. In particular it is essential that a serviceable tow-bar and tug is available in order that the aircraft can be pushed back from the parking stand.

RFF Category 10 cover is in place for the purpose of A380 flights.

4.2. Runways available

Runway 05L-23R has a total paved width of 90 metres, comprising 45 metres full bearing strength between edge-lights, plus 2 x partially load-bearing shoulder of 23 metres width.

Runway 05R-23L has a total paved width of 60 metres, comprising 45 metres full bearing strength between edge-lights, plus 2 x partially load-bearing shoulder of 7.5 metres width. A380 operations are certified to land on this type of runway.

A380s will generally operate through Manchester under the same Segregated runway manner as other aircraft. The exception will be that in most cases A380s will depart from the Runway 23L in preference to 23R. When this happens during single-runway 23R operations, the A380 departure off 23L will be a 'dependent' operation. Dependant operations may be subject to short delays to enable traffic sequencing.

4.3. Taxiway routings available

Taxiway routings for the A380 are strictly limited by the requirements of main-wheel to edge of pavement clearance, wingtip obstacle clearance, pavement loading and jet blast considerations. Only the routings listed below are to be used. An Airfield Operations Follow-Me vehicle will escort all A380 aircraft between runway and stand on all routings to the north of Runway 05L-23R, except during LVP when sequential (progressive) taxiway centreline lighting will guide the pilot along the authorised route.

Primary A380 routings are designed to ensure compliant adequate main-wheel to pavement edge clearance on the basis of cockpit-over-centreline steering. On secondary A380 routings pilots are advised that 'judgemental over steering' techniques may be required at certain taxiway intersections in order to ensure main-wheel to edge of pavement clearance is maintained at 4.5 metres. A chart indicating the A380 routings is published in the UK AIP.

Movement	**Primary Routing**	**Remarks**
		All ground movement north of Runway 05L-23R to be accompanied by Follow-Me vehicle, except in LVP.
Arrival Runway 23R	Exit runway via RET AE, AG, or Alpha. Then via Taxiways Alpha, Bravo, Kilo, and Delta to Stand 12 / 62.	If required to wait for stand to become available the aircraft should be held at A3.
Arrival Runway 05L	Exit runway at JA or Juliet to be met by Follow-Me vehicle.	

	Route via Taxiway Juliet, Kilo, and to Stand 12 / 62	
Arrival Runway 05R	Exit runway at VA or Tango. Route via DZ (or FZ) to cross Runway 05L. Route via Delta (or Kilo/Delta) to Stand 12 / 62	No Follow-Me required from D1 to stand 12.
Departure 23R	Pushback from Stand 12/62 to face south, then taxi via Delta, Kilo, and Juliet with Follow-Me to J1 for departure.	
Departure Runway 23L	Route via Delta (or Kilo/Foxtrot) to cross 23R, to hold at Tango 1.	No Follow-Me required from Stand 12 to stand D1.
Departure 05L	Pushback from Stand 12/62 to face south, then taxi via Delta, Kilo, Bravo, and Alpha to hold at A2.	
All, during LVP	CAT II/III holding point is D3, then A2	

4.4. Parking Stands

The parking stands to be allocated to A380s are Stand 12 or 62.

Scheduled passenger A380 flights will be parked at Stand 12, Terminal 1. Stand 12 has a 'MARS' (multiple-choice centreline) layout. A380s will always park on the main centreline '12' using the Safedock VDGS. Stands 12L and 12R are unavailable when Stand 12 centre is occupied by any type.

Stand 62 will be used on occasions when Stand 12 is not available.
The aircraft must be parked under marshaller's instructions, nose-in on the centreline of the stand using the stop mark 'A380'. When using Stand 62, Stand 61 is unaffected, whilst Stand 63L is closed and Stand 63 Centre is restricted to aircraft with a wingspan of 60 metres or less (B747-200/300 or B777-200 or A330-300). See Figure 1 for illustration.

4.5. Turnaround arrangements

There is adequate space around the aircraft at Stand 12 and 62 for all turnaround activities to be performed and the clearances available comply with the latest MA stand design characteristics, with the exception at Stand 62 only of the clearance between the port wingtip and the adjacent airside road. This is 1.5 metres rather than the normal 4.5 metres but is considered acceptable due to the height of the wingtip from the ground and the very low frequency of the event.

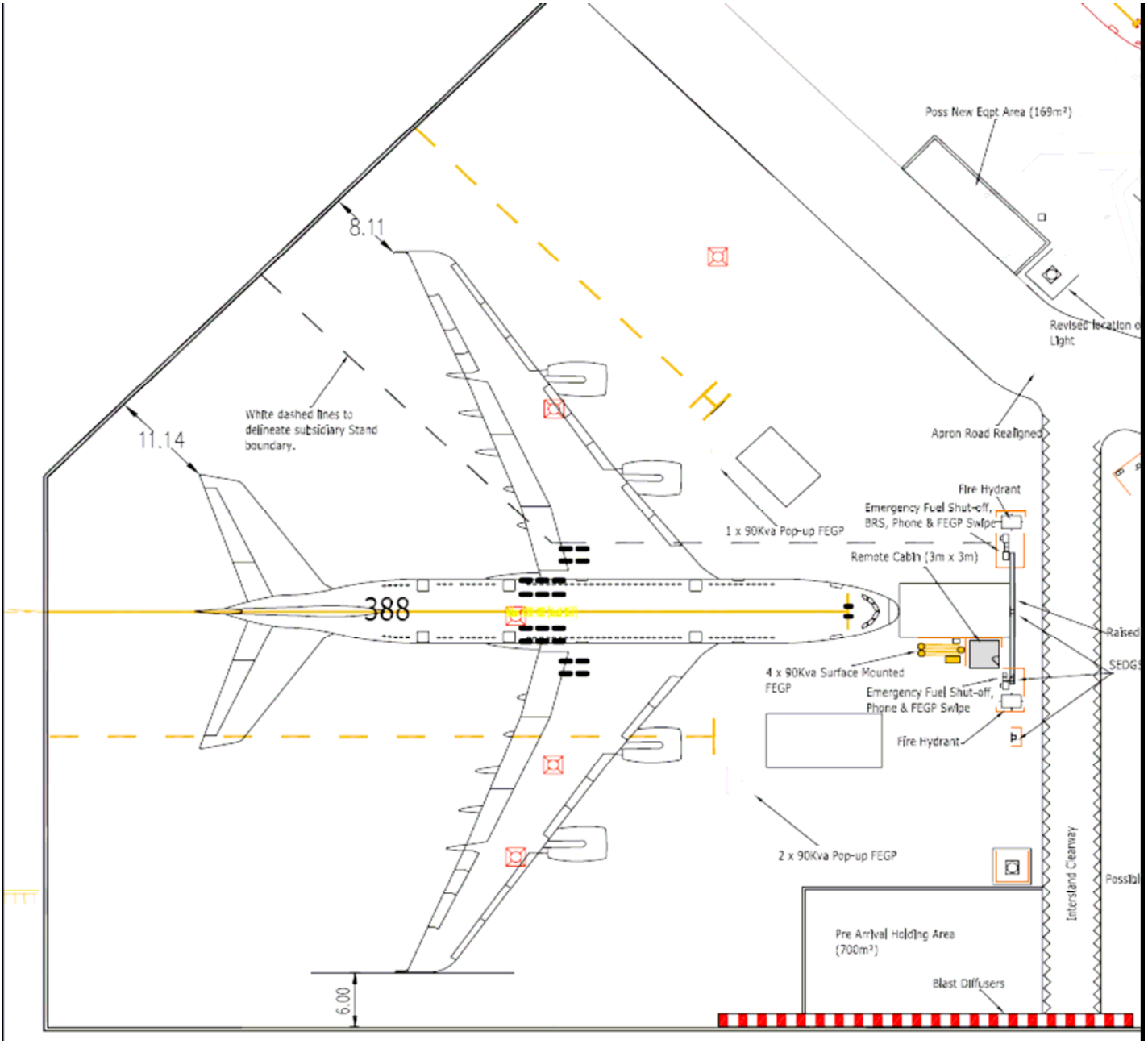
Fuel hydrants are located in the pavement beneath both inboard engines. Stand 12 is equipped with 4 x 90kVA Fixed Electrical Ground Power units at the head of stand. There is no FEGP at Stand 62 and therefore handling agents must provide mobile ground power units as required and/or the aircrafts' Auxiliary Power Unit must be kept running. 2x 180kVA or 4 x 90kVA may be required to power all on-board services. If sufficient mobile units are not available, the aircraft's APU may be run during the turnaround.

Pushback procedure from Stand 12 is through a 90 degree left turn onto taxiway Delta, Tug-Release Point 12, which keeps the aircraft tail short of stop bar D5.

Pushback procedure from Stand 62 is through a 90-degree right turn with the aircraft facing south astride Taxiway Delta and tug release abeam Stand 62 centreline.

Engine start may not always be completed prior to tug-release, and therefore the aircraft may occupy the TRP for up to 3 minutes.

Stand 12 – A380 parking arrangement (airbridges not shown)


Poss New Eqpt Area (169m²)
8.11
Revised location o
Light
White dashed lines to
delineate subsiciary Stand
boundary.
11.14
Apron Road Realigned
Fire Hydrant
Emergency Fuel Shut-off,
BRS, Phone & FEGP Swipe
1 x 90Kva Pop-up FEGP
Remote Cabin (3m x 3m)
388
Raised
SEDG
4 x 90Kva Surface Mounted
FEGP
Emergency Fuel Shut-off,
Phone & FEGP Swipe
Fire Hydrant
2 x 90Kva Pop-up FEGP
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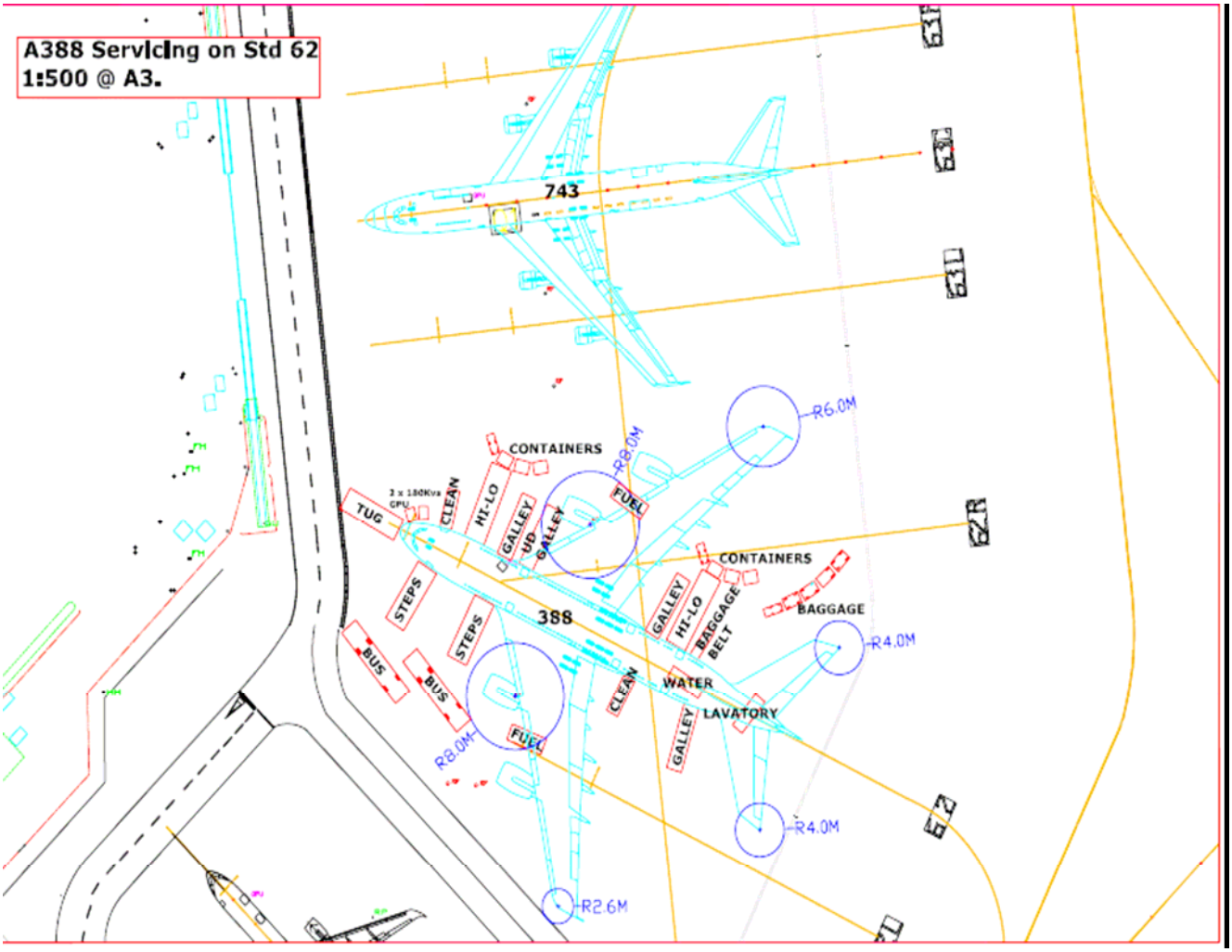
Pre Arrival Holding Area
(700m²)
Blast Diffusers
6.00

Stand 62 - A380 parking arrangement



Appendix 2 - Compliance Matrix

Feature	Code F requirements	CAP 168 Reference	Compliance status	Evidence, where required	Safety measures and comment
Runways					
RUNWAY 05L-23R	60m width	Ch. 3, 3.2.1.	No 45m width		Meets AACG. A380 certified to use 45m runways
	7.5m paved shoulder	Ch. 3, 3.7.3.	Yes 23m shoulder width.		
	105m C&G Area	Ch.3, 4.4.	No. Some buried structures within 05L/23R strip require de-lethalisation. Programmed for completion 2011 as part of runway refurbishment.		Existing non-compliance with agreed resolution date.
	RESA minimum 90m	Ch.3, 5.3.	Yes 240m at both ends.		Meets ICAO Recommendation, with LYTAG Arrester Bed on 23R.
RUNWAY 05R-23L	60m width	Ch.3, 3.2.1.	No 45m width.	Bearing strength and stability of shoulders tested by running fire appliance. Able to most RFF vehicle in most cases.	Meets AACG. A380 certified to use 45m runways, and 58m total pavement width.
	7.5m paved shoulder	Ch.3, 3.7.3.	No Outer shoulders comprised of stabilised unpaved ground.		Stability of shoulders endorsed by airline flight operations following site inspection. Condition checked daily.
	105m C&G Area	Ch.3, 4.4.	Yes		
	RESA minimum 90m	Ch.3, 5.3.	Yes 240m or greater		ICAO Recommendation

Runway Holding positions	Minimum distance to runway centreline for CAT I operations 107.5m	Ch. 3, Table 3.3., note 5.	No At the following locations this is only 105m : AF1, B1, D1, F1, G1, H1. At A1 the distance is 90m.		Very marginal non-compliance. No fixed obstacles within Code F OFZ. A2 (137m) will be used during A380 operations. All holding positions will be relocated to 137m offset in due course.
A380 Primary and Secondary Taxiways					
Rapid-Exit Taxiway Alpha-Echo	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m Yes		Meets AACG Meets AACG
Link Alpha	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m. Yes		Meets AACG Meets AACG
Link Juliet	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m Yes		Meets AACG Meets AACG
Taxiway Alpha A1-A3	25m width 55m half-strip width	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4.	No At least 23m No At least 49m		Meets AACG Meets AACG

	30m C&G Strip 190m offset from runway	Ch.3, 7.6.2. Ch.3., Table 3.4.	Yes No 185 metres (5 metres less)		Marginal non-compliance.
Taxiway Alpha A3 – junction with Taxiway Bravo	25m width 55m half-strip width 30m C&G Strip 190m offset from runway	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2. Ch.3., Table 3.4.	No At least 23m No At least 49m Yes Yes In excess of 190 metres		Meets AACG Meets AACG
Taxiway Kilo	25m width 55m half-strip width 30m C&G Strip 90m offset from adjacent Code E taxiway 190m offset from runway	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2. Ch.3., Table 3.4. Ch.3., Table 3.4.	Yes Yes Yes Yes except for K4-K5. Yes exceeds minimum.	Converging alignment with Taxiway Bravo.	Procedural separation employed.
Taxiway Juliet J6-J4	25m width 55m half-strip width 30m C&G Strip 81m offset from adjacent Code D taxiway	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2. ICAO Aerodrome Design Manual, Ch.1, 1.2.72.	No At least 23m No At least 49m Yes No Clearance reduces to 68m.		Meets AACG Meets AACG Procedural separation employed.

	190m offset from runway	Ch.3., Table 3.4	**No** Clearance reduces to 171m.		No procedural separation. Risk accepted.
Taxiway Juliet J3-J1	25m width 55m half-strip width 30m C&G Strip 81m offset from adjacent Code E taxiway 190m offset from runway	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2. CAO Aerodrome Design Manual, Ch.1, 1.2.72. Ch.3., Table 3.4	Yes **No** At least 49m Yes **No** 68m offset from taxiway Golf Yes		 Meets AACG Procedural separation employed.
Taxiway Delta D5-D1	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	Yes **No** At least 49m Yes		 Meets AACG
Taxiway Delta D5- abeam Stand 62	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	Yes **No** At least 49m Yes		 Meets AACG
Taxiway Foxtrot-Zulu	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	**No** At least 23m. **No** At least 49m		Meets AACG Meets AACG

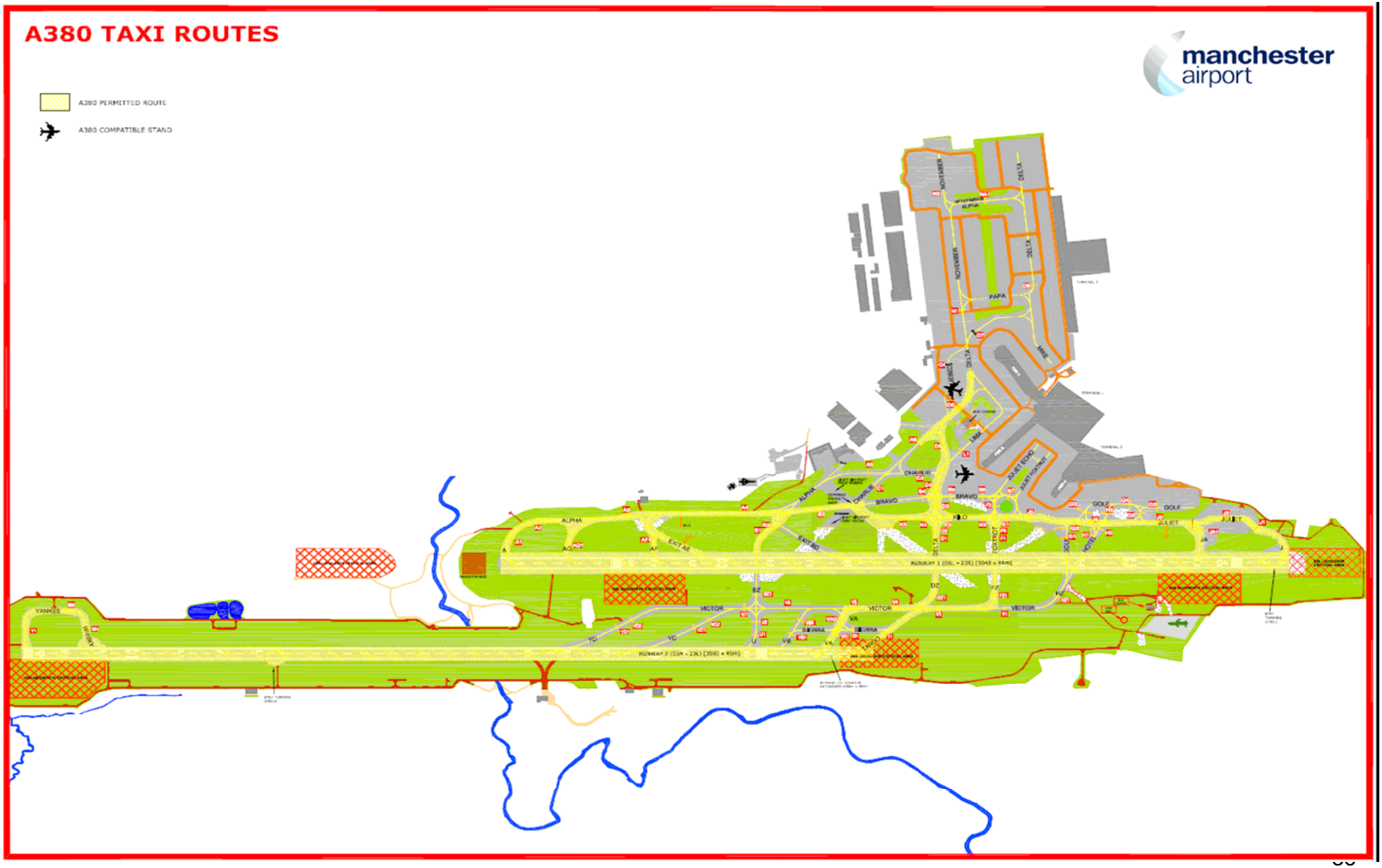
Taxiway Foxtrot	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m Yes		Meets AACG Meets AACG
Taxiway Victor V3-V5	25m width 55m half-strip width 30m C&G Strip 190m offset from runway	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2. Ch.3., Table 3.4.	No At least 23m No At least 49m Yes Yes		Meets AACG Meets AACG
Link Tango	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m Yes		Meets AACG Meets AACG
Link Victor-Alpha	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m Yes		Meets AACG Meets AACG

Link Delta-Zulu	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m Yes		Meets AACG Meets AACG
Taxiway Whiskey/Yankee	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m Yes		Meets AACG Meets AACG
A380 contingency taxiway routings					
Link AG	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 47.5m Yes		Meets AACG Only to be used when backtrack of runway required.
Link JA	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	Yes Yes Yes		

Taxiway Alpha (A4-A6)	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 47.5m (Code E). No At least 22m (Code E)		To be used under tow only.
Taxiway C	25m width 55m half-strip width 30m C&G Strip	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2.	No At least 23m No At least 49m Yes		Meets AACG Meets AACG
Taxiway & Link Bravo	25m width 55m half-strip width 30m C&G Strip 90m offset from adjacent Code E taxiway	Ch.3, 7.2.1. & 7.2.3 Ch.3., Table 3.4. Ch.3, 7.6.2. Ch.3., Table 3.4.	No At least 23m No At least 49m Yes Yes except for section east of Compass Swing base		Meets AACG Meets AACG Procedural separation employed.

Safeguarding					
Obstacle Limitation Surfaces	Code 4F	Ch. 4,	**No** Some existing non-compliances with respect to Approach / Transitional / Take-Off Climb Surfaces.	Latest Full Survey 2006, Check Survey 2009.	These are already the subject of Variations and/or and published in the relevant AIP entries.
Obstacle Free Zone	77.5m offset inner edge then 1:3.	Ch.4, 8.5	Yes	Latest Full Survey 2006, Check Survey 2009.	No actions required to provide extended strip.
Navigational Aids within runway strips	Code 4F 1:10 slope from runway centreline	Ch.4, 4.6 c)	**No** 05L Glide Path antenna penetrates 1:10 surface by 0.68m	Latest Full Survey 2006, Check Survey 2010.	Existing Variation (4)

A380 TAXI ROUTES



Appendix 4 Ground Movement Restrictions

A380 Authorised Routings – matrix of procedural constraints				
	Visual /Cat I operations		*Low Visibility operations*	
A380 location	**Constraint**	**Special procedure to be applied**	**Constraint**	**Procedure to be applied**
Hold A1	-	-	-	-
Taxiway Alpha A1 to A4)	-	-	-	-
TWY Alpha/Bravo (A4 to Compass Swing Base)	-	-	-	-
Taxiway Foxtrot / Hold F1	AACG route except clearance to K1 is 47.5m.	No aircraft to be holding at K1. Advise ADM before use. Proceed with caution due jet blast / object clearance	As for CAT I	As for CAT I
Hold FZ1	-	-	DLSA infringement	No departing aircraft rolling. No landing aircraft within 3nm from touchdown
Taxiway Kilo	Separation from Taxiway Bravo	No aircraft on Taxiway Bravo west of B4	DLSA infringement	No departing aircraft rolling. No landing aircraft within 3nm from touchdown
Taxiway Juliet (J5-J2)	Separation from Taxiway Golf	No aircraft on Taxiway Golf	DLSA infringement	No departing aircraft rolling. No landing aircraft within 3nm from touchdown
	Separation from RWY 05L-23R	Standard (risk accepted)	DLSA infringement	No departing aircraft rolling. No landing aircraft within 3nm from touchdown
Taxiway Juliet (J2-J1)	-	-	-	-
Taxiway Delta (D6-Hold D1)	-	-	DLSA infringement (south of D3)	No departing aircraft rolling. No landing aircraft within 3nm from touchdown
Hold DZ1			DLSA infringement	No departing aircraft rolling. No landing aircraft within 3nm from touchdown
Tango / Hold T1	Infringes 23L OFZ	No 23L landings whilst A380 at T1	As for CAT I	As for CAT I
W/Y loop, including Hold W1 and Hold Y1	Infringes 05R OFZ	No 05R landings whilst A380 at Y1.	As for CAT I	As for CAT I

A380 Contingency routings (may be used only when primary route unavailable)				
	Visual /Cat I operations		**Low Visibility operations**	
A380 location	**Constraint**	**Special procedure to be applied**	**Constraint**	**Procedure to be applied**
Taxiway Alpha (A4-A5)	Code E route. Parked aircraft on Ocean Sky apron and ROMPA	**A380 under tow only**	As for CAT I	As for CAT I
Taxiway Bravo (B5-B6 towards F3)	Code E route. Jet blast hazard to Stand 15	**A380 under tow only**	As for CAT I	As for CAT I
Taxiway Alpha (through A6)	None (meets AACG)	Advise ADM before use. Proceed with caution due jet blast	As for CAT I	As for CAT I
Taxiway Bravo (East of Compass Swing Base)	Code E route Limited wheel clearance on turn B4-D4. Separation from Taxiway Kilo	Advise ADM before use. Proceed with caution due jet blast / object clearance. Over-steer required. No aircraft on taxiway Kilo (West of K4)	As for CAT I As for CAT I	As for CAT I As for CAT I
Taxiway Charlie (C1 section only)	Code E route	Advise ADM before use. Proceed with caution due jet blast / object clearance	As for CAT I	As for CAT I
Taxiway Victor V4-V5	-	-	-	-
Victor-Alpha / Hold VA1	05R LSA infringement	No arrival within 4nm from touchdown 05R	As for CAT I	As for CAT I