



**CODE F AIRCRAFT OPERATION
A380/B747-8 SPORADIC - ALTERNATE
ALFONSO BONILLA INTERNATIONAL AIRPORT**



CALI-COLOMBIA

November 2017



ÍNDEX

1	Introduction.	3
1.1	Purpose of the Document.....	5
1.2	Area of Application.....	6
1.3	Glossary Terms.	6
1.4	Reference Documents.	7
2	Infrastructure requirements.	7
3	Alternative measures, operational procedures and operating restrictions.	8
3.1	Runways.....	8
3.2	Taxiways.	14
3.3	Runway – taxiway separations.	17
3.4	Obstacle Free Zone (OFZ).	19
3.5	Runway Holding Positions.	20
3.6	Taxiway minimum separation distances.....	21
3.7	Aprons and aircraft stands.....	23
3.8	Taxi Routing.....	24
3.9	Emergency planning.	36
3.10	S.E.I.....	36
3.11	Aircraft Recovery Plan.	36
3.12	Ground handling.	37
4	Planning the operation.	37
5	Conclusions.	37



1. Introduction

ICAO classified B747-800 and A-380 aircraft as code F (wingspan from 65 to 80 meters and a width of the main fuselage from 14 to 16 meters), this type of aircraft are heavier and longer than A340-600 and B777.

Code F aircraft could have occurrences of flight diversions and many alternate airports will see only a few diversions a year or, in the case of emergency alternates, may never see one. It may therefore be reasonable and admissible to maintain the level of operational safety by use of alternative measures, operational procedures and operating restrictions. The two cases of alternates (flight diversion or emergency alternate) require different consideration. Those nominated regularly for use as a destination or takeoff alternate must meet a defined standard, which many states require to be similar to that of the scheduled destination.

Code F aircraft is similar to that currently occurring with the operation of aircraft code E, such as the B747-400 or An124. However, for sporadic code F aircraft operations because of diversions alternative measures, special operational procedures and certain restrictions are required to ensure that these operations comply with ICAO SARPs in the safest and most optimal manner and in compliance with ICAO SARPs.

Alfonso Bonilla Aragón International Airport located in the southwest of Colombia serves as an alternate airport of the international airport Eldorado of Bogota, Rionegro of Medellín and other airports of the country. Because of its geographical location, Cali Airport serves as an alternate airport for international airports in neighboring countries.

Consequently, it is essential to prepare and develop a document and procedures that facilitates the code F aircraft operation that due to bad weather, emergency or any other circumstance requires operating in the Alfonso Bonilla Aragón.

Alfonso Bonilla Aragón International Airport. The airport is managed by Aerocali S.A. and operated by AENA of Spain and Corficolombiana a main finance company of Colombia. The Civil Aeronautics of Colombia and the United States Transportation Security Administration (TSA) oversee airport security.



It is an H-24 category ICAO 4E airport where E code aircraft such as B777, B787, and A-330 operate regularly. Cali airport had operated the A-340-600, B-747-400 and even the An124. Alfonso Bonilla Aragón International Airport has direct flights to Central and South America, the United States, Europe and international connections to other parts of the world.

Airport Certification. Alfonso Bonilla airport was the first airport certified in Colombia on November 2017 by the Aeronautical Authority of Colombia in compliance with the safety standards issued by the International Civil Aviation Organization, ICAO.

Strategic location. Bonilla Aragón Airport is conveniently located at 3,162 ft. /964 meters. On the mean sea level (MSL) and 80 kilometers from the Pacific Ocean. Approximately 5 hours flight from Santiago de Chile, 50 minutes from Quito or Panama and 3 hours 18 minutes from Miami. This airport (H24) is strategically located in the Western Hemisphere for flights from the transcontinental zone of the Pacific corridor that connect North America with South America.

The weather conditions are the best and the seasonal availability is of the whole year, since the sum of the time in which the airport exceptionally closes due to meteorological causes, does not arrive even on average to an hour in the year. It has an average temperature of 23.8 degrees Celsius and an average dry humidity. On the other hand, the airport is located in a valley surrounded by crops 18 kilometers away from the city of Cali and 12 kilometers from Palmira, which allows us to operate without any environmental restrictions.

Technical specifications. The airport has a 9.842ft runway. / 3000mts x 45 mts. and taxiways of 23 mts. Both the runway and the taxiways have margins of 7.5 meters. Each end runway has its safety zone-RESA. It is equipped with the following aids: Primary Radar, Secondary Radar, ILS CAT I, ALS, REIL, PAPI, VOR, NDB, DME, all RWY and TWYs have LED lights. SEI has ICAO level of protection VIII.

TERMINALS. The airport has three terminals. Terminal ONE for domestic operations, Terminal TWO for international operations and cargo Terminal. It has five ramps areas with 25 parking positions for passenger and cargo operations and 14 boarding bridges.

Operations. Currently, there are approximately 65,000 operations per year, with airlines operating with airlines such as Copa Airlines, American Airlines, Avianca, AEROGAL, TACA, ADA, LATAM, Satena, TAC, Tame and Wingo. The airport has international flights to Madrid, New York, Miami, Lima Guayaquil, Quito, San Salvador, Esmeraldas and Panama. Likewise, there are operations



of cargo companies such as Avianca Cargo, Centurión, LATAM Cargo, Aerosucre, Líneas Aéreas Suramericanas and other freighters that operate from time to time. These companies operate with different types of aircraft, such as B-747, 787, 777, 767, 757, 737, A-330, 320, 321, 318, 319, ATR-72, Emb-175-190, etc.

Cali's airport is the alternate airport for other cities in the country and sometimes we have other international flights such Lufthansa, Air France, TACA, LATAM, Martín Air, Delta, KLM, Iberia, and Continental. Very often we have at the airport US military operations (USAF, USARMY USNAVY) and US government aircrafts. In addition, it is use as a technical stop for several international airlines.

We have available the following handling companies for ramp services and FBO: GIRAG, LASA, TAESCOL, SAI, MENZIES, AEROSUPPORT and CARIBBEAN SUPPORT.

TERPEL and ENERGIZAR operate fuel service and offer the same quality standard, security, and service offered by other international airports in the world. The fuel facilities are under the supervision the United States government personnel and the Engineering Department of American Airlines.

Finally, Alfonso Bonilla airport has approximately 370 acres (16.145.000ft²) of land available for any aviation company interested in the construction of cargo logistic centers, warehouses, maintenance bases or hangars.

1.1 Purpose of the Document

The purpose of this document is:

- *Identify the elements of airport infrastructure affected by the operation of Code F aircraft such as B747-800, A380 or similar*
- *Determine the requirements established by ICAO SARPS in relation to these elements*
- *Propose the alternative measures, operational procedures and restrictions that must be applied to ensure a level of safety in operation equivalent to the obtained will full compliance of ICAO SARPS.*

Circular 031 **[DR 10]** from Civil Aeronautics of Colombia has been used as a guide, as well as the following documents: **[DR 2]** document: ICAO Circular on New Larger Aeroplane Operations on Existing Aerodromes. Cir 305 An/177 June 2004, **[DR 4]** AACG. Common Agreement Document of the A380 Airport Compatibility Group Version 2.1. December 2002 and other related reference



document listed in Numeral 1.4 . It is important to note that some of the issues listed in the reference documents do not apply to the infrastructure, geographic and meteorological conditions of Cali's airport.

1.2 Area of Application

This document is applicable at the Alfonso Bonilla Aragon International Airport of Cali-Colombia during the sporadic F code aircraft operation such as B747-800, A380 or similar during a technical scales, emergencies or sporadic diversion.

1.3 Glossary Terms

AACG: *A380 Aerodrome Compatibility Group Informal group composed of the aeronautical authorities of Germany, France, Holland, United Kingdom and institutions of the international industry (ACI, AIRBUS, and IATA). Its objective is to promote a common position among its members for the application of ICAO requirements, regarding the operation of A380 aircraft in terms of infrastructure and operations in the main European airports that do not fully meet the established requirements.*

AEROCALI: *Alfonso Bonilla Aragon International Airport Concessionaire. (Cali-Colombia).*

COCL: *Taxiing technique in which the cockpit remains on the taxiway axis*

FAA: *Federal Aviation Administration*

FOD: *Foreign Objects Debris*

LVC: *Reduced Visibility Conditions*

ICAO: *International Civil Aviation Organization*

MLW: *Maximum Landing Weight*

MTOW: *Maximum Take-off Weight*

NLA: *New Larger Aircraft*

RWY: *Runway*

SARPS: *Standard and Recommended Practices*

SEI: *CFR Crash Fire Rescue*

TWY: *Taxiway*

VFR: *Visual Flight Rules*

ILS: *Instrument Landing System*

1.4 Reference Documents



The present document has been prepared having in consideration the following documents:

[DR 1] ICAO Annex 14 Vol 1 Design and Aerodrome Operations. 4th Edition 2004

[DR 2] ICAO Circular on New Larger Airplane Operations on Existing Aerodromes. Cir. 305 – An/177 June 2004

[DR 3] ICAO Aerodrome Design Manual. Part II taxiways, platform and waiting areas. Doc 9157

[DR 4] AACG. Common Agreement Document of the A380 Airport Compatibility Group

[DR 5] AACG Airbus A380 Operations Alternate Airports. Second Edition Draft November 2004

[DR 6] FAA. Engineering Brief. Nr 63 Use of Non-Standard 75-Foot Wide Stright Taxiway Sections for Airbus A380 Operations August 2003

[DR 7] FAA. Engineering Brief Nr 65 Minimum Requirements to Widen Existing 150- Foot Wide Runways for Airbus A380 Operations. February 13 of 2004

[DR 8] www.content.airbusworld.com/SITES/Technical_Data/docs/AC/DATA_CONSULT/AC_A380.pdf

[DR 9] www.ecac-ceac.org/nla-forum/index.php

[DR 10] Regulatory Technical Circular 031. Civil Aeronautic of Colombia.

2. Infrastructure requirements

ICAO in Annex 14 gives airside infrastructure requirements for aircraft with a wingspan up to 80 meters (Code F). These requirements are a sound basis for new airport design or future airport expansion but in most cases impractical for determining changes to existing infrastructure. **Alfonso Bonilla international airport complies with the ICAO code E requirements.**

3. Alternative measures, operational procedures and operating restrictions

In assessing the suitability of a given airport as an A380 o similar aircraft alternate, two situations can be distinguished:

- The case of a planned alternate, where the airport is regularly declared in the flight plans of an airline as the alternate in the case of unavailability (most of the time for weather conditions) of the destination airport. In this case, the conditions of accommodation can – and should – be negotiated in advance



by the airport with the airline and the ATC services. There may be some restrictions to “normal” operations, but they should not be disruptive – if only because, in the case of bad weather, the A380 or similar aircraft is unlikely to be the only diverted aircraft and the alternate airport also has to handle its own traffic.

- *The case of an unplanned diversion airport, most likely to be used for an aircraft emergency. In such a (rare) case, temporary disruption of operations at the alternate airport is to some extent tolerable.*

The level of the operating restrictions that can be tolerated will be higher in the second case.

The measures proposed in this document are elaborate for a code E airport and Alfonso Bonilla Aragón international airport fulfills the requirements established by ICAO for code E airport.

3.1 Runways

Runway width.

Annex 14 prescribes a runway width of 60m for Code F aircraft. Many long-range traffic airports however, and certainly those that will be filed as an alternate, have runways which are expected to comply with ICAO Code E requirements, i.e. a width of 45m.

Subject to the A380 for example being certified on 45m wide runways, the AACG recommendations state that a 45-meter wide runway can be used for Airbus A380 operations.

*On the other hand, risks studies developed by the AACG in **[DR 4]** indicates that A380 standards are very similar to regular aircraft such as B747 or A340.*

Alfonso Bonilla Aragón International Airport has a 3000mts long runway, 45 mts. width and 7.5 mts. shoulder each side.

No specific alternative measures, operational procedures and operating restrictions are proposed for operations on a 45 meters runway.

Runway strength



The [DR 5] document indicates that the runway needs only to support the reduced operating weight at an alternate (airlines have quoted maximum MLW and two hours fuel) and the infrequent use would allow pavement concession action for the appropriate bearing strength.

In this case, A380 and B747-800 are very similar to regular aircraft operations, therefore Cali airport runway strength does not have any inconvenient managing code F aircraft.

No specific alternative measures, operational procedures and operating restrictions are proposed for operations related to runway strength code F aircraft operations.

Runway shoulders

For destination airports, AACG recommendations state that a 45 meters wide runway with 7.5-meter shoulders on both sides can be used for Airbus A380 operations if the runway is also provided with additional “outer” shoulders. These outer shoulders should be prepared for jet blast protection, engine ingestion protection, and for supporting ground, vehicles and their width should be at least 2x7.5m.

The use of 2 7.5 meter shoulders in Code E alternate airports instead of 2*15 meter wide shoulders (including the AACG “outer” shoulders) could therefore be an issue.*

For an alternate airport, upgrading the total runway + shoulder width to 75m is mostly not viable. To find whether, and under what conditions, the A380 can be operated on code E runways and shoulders, the focus should be put on the intended use of the “outer” shoulder.

Annex 14 prescribes runway shoulders of 75 meters. The document [DR 4] recommends the use of 2 7.5 meter shoulders in Code E alternate airports in a 45 mts. runway. The document [DR 5] says that the total runway + shoulder width to 75m is mostly not viable.*

Alfonso Bonilla international airport has a 45 meters runway and 2 * 7.5 m runway shoulders that guarantee the operation.

- To determine the conditions to operate A380, B747-800 same as code E aircraft , some things may be considered when it comes to runway shoulders:

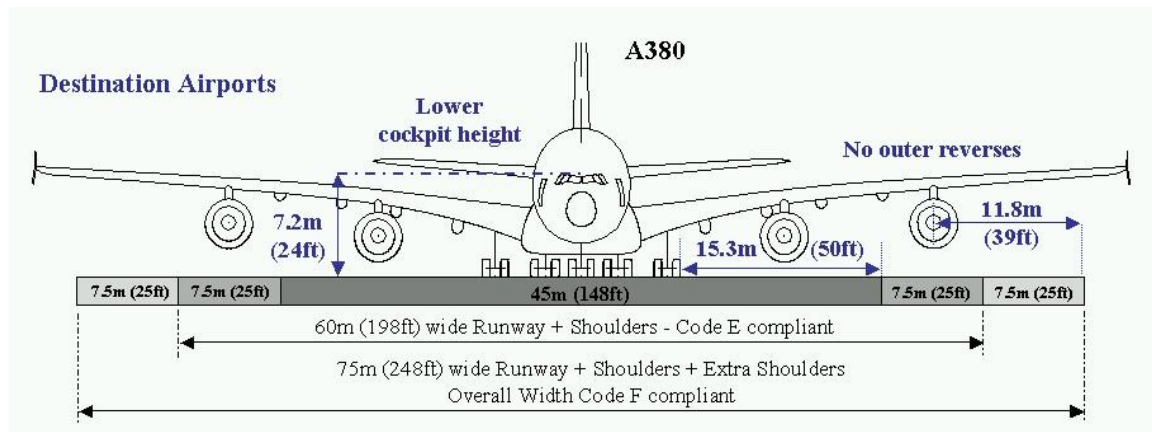
1. Jet blast and engine ingestion protection

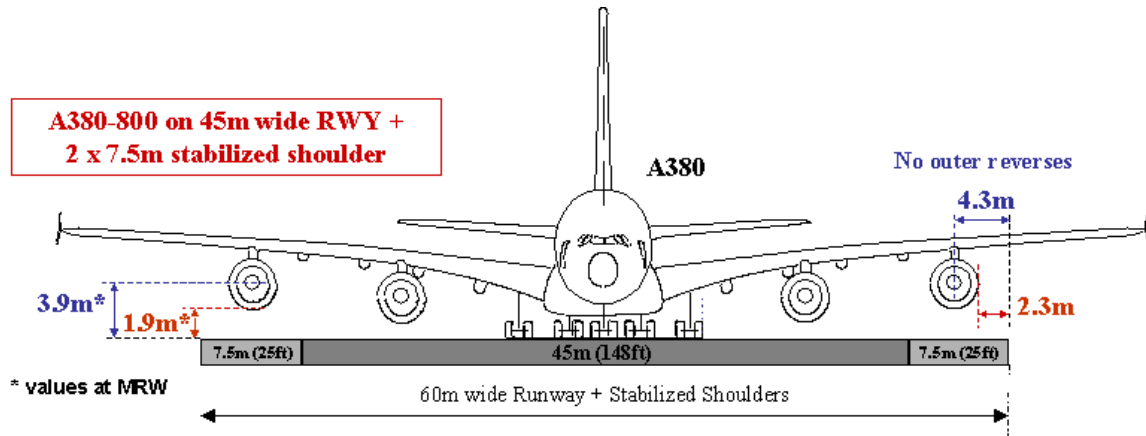


The outboard engine of the A380 is located inside the shoulder of a code E runway (see picture below), so there is still some protection against any blast, erosion and A380 outer engine ingestion that could be generated by its thrust.

On landing, blast, erosion and A380 engine ingestion protection is not critical for the A380 on such a runway, as the outboard engines are not fitted with thrust reversers.

Take-offs however may require the blast and erosion protection capabilities of the outer shoulders, beyond the 4.3m margin offered by the inner shoulder. Absence of the “outer” shoulder could result in an ingestion risk for the A380 on takeoff, or FOD on the runway or inner shoulders, which could be hazardous for the following movement.





Use of a runway at a landing alternate is likely to happen on short notice. The landing does not present a specific risk and therefore special procedures are not necessary (although runway inspection is advisable).

In any case, during a code F operation on Cali International Airport the next procedure should be considered:

In the take-off case, it is precise to inspect the runway before it happens. Runway inspection must be carried out immediately after takeoff to check that no loose objects have been blown onto the runway. In addition, the cabin crew can be call asking to reduce the engine hazard.

2. Supporting ground vehicles

The other function of the outer shoulder is to allow the passage of ground, mainly emergency, vehicles. The wingspan of a Boeing B747-400 already exceeds the runway and shoulder width of a code E runway. For code E runways, the emergency vehicles already must be capable to make use of the strip part outside the runway shoulder.

Rescue and Fire Fighting vehicles are designed for operating over short distances on the natural soil of the runway strip. The lack of 7.5 meters of "outer" shoulder does therefore make no difference between code E and code F operations.

3. Bearing strength

The inner shoulder must be capable of withstanding the occasional passage of the aircraft without incurring structural damage to the aircraft. A380 alternate



airport operations would result in a pavement loading below or comparable to the most critical code E aircraft at Maximum Take-Off Weight (B777-300ER). If the shoulder is for example designed for the critical B777-300ER at MTOW, it should cater for an A380 at alternate airport weights

The suitability of the runway and shoulder pavement for an A380 take-off is therefore a matter of comparing it with the critical aircraft used for the design of the airport pavement.

The outer shoulder does not have to be designed for the occasional passage of an aircraft. OACI says in [DR 2] that the outer shoulder can be stabilized pavement

Alternative measures, procedures and operational restrictions proposed in relation to margins (in combination with a 45 m wide track)

Runway inspections will be carried out eventually before A380 or similar aircraft take off so any FOD in the area can be found.

Note: There must be aircraft TOW restrictions in case that runway PCN requires it. It is recommended that the MLW count with extra fuel in case of emergency.

3-1. Runway End Safety Area (RESA)

Annex 14 requirements:

- *Aircraft Code 4 rule. Minimum 90 meters long and double runway width*
- *Recommendation for aircraft code 4: 240 meters long and width of the leveled part of the strip.*

The minimum RESA dimensions are linked to the aircraft code and runway width. The A380 or B747-800 aircraft operations does not mean any inconvenient to the airport logistic.

Consequently, no alternative measures, procedures or operational restrictions are proposed in relation to the RESA.

- *However, the results can be supplied with RESAs of the largest possible dimensions. Cali's airport RESA is 90 mts. x 90 mts.*

4. Runway edge lights

Annex 14 requirements: Runway edge lights are provided along both sides of the runway. They are located on the edge of the runway or a maximum of three



meters to the outside of the edge. In most cases elevated and frangible constructions are used that could be subject to engine blast as the edge lights are almost in line with the outer engines.

According to [DR5] available lights can take such effect.

Cali international Airport can perform runway edge light inspection after each code F aircraft departure. As the outer engines are not fitted with thrust reverse systems, it is not required to perform a runway edge light inspection after the landing.

Proposed alternative measures, operational procedures and operating restrictions for airports with non blast resistant elevated runway edge lights on a 45 meters wide runway.

- Runway edge lights inspection after each code F aircraft departure.

PAPI LIGHTS

Annex 14 requirements:

- *On the tracks for non-precision approach PAPI lights are installed to ensure the guidance to the most demanding aircraft that normally use the runway.*
- *On runways for precision approach, it should be located to provide guidance for aircraft that regularly use the runway.*

The location of the PAPI units depends on the vertical distance between the pilot's eye and the wheels of the most demanding airplane that uses the runway.

In the case of the A380, this distance is inferior than B747 is, meaning that PAPI will not be affected.

Regularly the Alfonso Bonilla Aragón International Airport has code E aircraft operations such as the B-777, B-787, A-330 or occasional B-747 and the PAPI system works without any inconvenience.

Alternative measures, procedures and operational restrictions proposed in relation to the PAPI, when their location is not adequate.

- Cali International Airport does not require relocating the PAPI units for the operation of any code F aircraft.



3.2 Taxiways

Taxiway width

Annex 14 requirements: 25 m

The A380 has a wheel track 0.3m larger than the Code E limit.

The [DR 2] has shown that the deviation of large aircraft (code E) is much less than the 4.5 meters margin used in the formula to determine the taxiway width. [DR 4] and [DR 5] AACG shows that a deviation of less than 2.5 meters is a very realistic value under the condition that proper guidance such as center line lights and markings.

Therefore, the A380, B747-800 on a 23 meters code E taxiway can taxi safely under the condition that this taxiway is provided with proper guidance.

AACG concludes that the A380 can safely roll in a taxiway of 23 meters. Under these conditions no specific operational procedures is required.

As a result, no alternative measures, procedures or operational restrictions are proposed on taxiways of 23 meters wide.

Width of curve Taxiway

The ICAO Annex 14 Code F taxiway width is 25m, or 2m more than Code E. The A380 has a wheel track 0.3m larger than the Code E limit.

Extensive deviation studies, carried out at several airports around the world, have shown that the deviation of large aircraft (code E) is much less, than the 4.5 meters margin used in the formula to determine the taxiway width. Results show that a deviation of less than 2.5 meters is a very realistic value under the condition that proper guidance such as centerline lights and markings or equivalent guidance is provided for night or low visibility operations.

Additional to the above, it can be stated that the outer main gear wheel span of the A380 is such that the actual wheel to edge clearance (4.3m) is more than the 2.5 meters if the aircraft is taxiing on a code E taxiway.

It can be concluded that on a 23-meter code E taxiway the A380 can taxi safely under the condition that this taxiway is provided with proper guidance. Under these conditions no specific operational procedures is required.



If the taxiways are not provided with proper guidance or if the airport / local authority does not feel comfortable with the use of 23-meter wide taxiways, the use of “follow me” guidance can be a solution.

Alternative measures, procedures and operational restrictions proposed in relation to the width of the taxiways in the curved sections.

Cali International Airport has in consideration the application of one or more of the following alternatives:

- Pilot estimates on Taxiways curves.
- Additional marks with more closed curves.
- Additional markings for over steering guidance.
- Publication in the aeronautical documentation.

Taxiway shoulder width

Both ICAO Annex 14 and the AACG Common Agreement Document recommend a 60 meters wide strip to be protected against shoulder erosion and engine ingestion risk. The shoulders could build up of a paved, a stabilized or a natural surface (experienced at CDG for many years). The A380 engine ground clearance is a factor. The inner engines are 0.5m higher and the outer engines 1.2m higher than the 747-400 ones, which would decrease the ingestion and jet blast risks. If the airport / local authorities does not feel comfortable with the shoulder surface in combination with A380 operations, the possibility remains to taxi with both outboard engines idle or even shut-off. The manufacturer must first confirm the feasibility of this.

Taxiing on two engines is not unusual but is mainly a practice after landing. Taxiing on two engines before take-off requires the outboard engines to be started up near or even at the runway, which can result in a long blockage of the runway and consequently disturbing other traffic flow.

If it is required that the outer engines being shut off, special attention should be given to tight curves where normally asymmetric power is used to move the aircraft through the curve.

To facilitate the movement of an A380 on curved taxiways and on junctions / intersections of taxiways with runways, aprons and other taxiways, fillets should be provided. The design of the fillet should ensure that a minimum wheel to edge clearance is maintained, based on Cockpit over Centre Line (COCL) steering technique. ICAO requires a minimum wheel to edge clearance of 4.5 meters for curved taxiway segments. Also the AACG recommendations mention a 4.5 meters wheel to edge clearance for curved taxiways, however in some



states the use of smaller wheel to edge clearances (i.e. 2.5 meters) for the design of taxiway fillets is under certain conditions accepted.

If the required wheel to edge clearance cannot be guaranteed when using COCL steering technique, judgmental over steering is required. The use of judgmental over steering must be published in the appropriate aeronautical publications. If even judgmental over steering is not sufficient or if the airport / local authority does not feel comfortable with this, additional markings (for over steering guidance) could be a practical solution

Alternative measures, procedures and operational restrictions proposed in relation to non-compliance with margin width recommendations.

Cali International Airport has in consideration one or more of the following alternative measures:

- Taxing with outboard engines on idle thrust: Airport operations personnel, ATC and cabin crew will coordinate the possibility to apply this procedure. This procedure could be apply once aircraft leaves RWY and starting engines to exit.
- In extreme case, the airport will coordinate with ATC and crew so that outboard engines be shut-off or aircraft could be towed.

3.3 Runway - taxiway separations

ICAO gives separation between runway and parallel taxiway as 115 meters for a non-instrument runway and 190 meters for an instrument runway. Both are applicable to code F. For code E, these separation distances are 107.5 and 182.5 meters.

ICAO criterion for establishing the separation between runway and taxiway is determined in [DR 3], as the sum of the half-width of the strip plus the maximum half-height of the aircraft operating on the taxiway (40 m. Aircraft F).

Although AACG agreed with the 115 meters, some members have the opinion that the 115 meters for non-instrument runways is at the very lower boundary of what could be acceptable. On the other hand, AACG also have the opinion that the 190 meters for instrument runways may be conservative¹.

¹ The FAA specifies a 600ft (182 m) separation in the US for FAA ADG VI category (equivalent to ICAO Code F). Other states are studying the issue of allowing lower separations than those of ICAO, code F. The ECAC NLA website is intended to reference those studies when available.



Within the frame of ICAO rules, if the runway-taxiway separation at an alternate airport with few (if any) foreseeable A380 movements does not comply with code F SARPs, restrictions on the simultaneous use of the runway and taxiway can be considered.

For this several cases can be distinguished, based on code E separation distances:

- a) Landing of an A380 on an non instrument runway, Runway – taxiway separation is 107.5 meters,
The runway – taxiway separation is based on a half runway-strip width of 75 meters plus half the wingspan of the aircraft on the parallel taxiway. The half runway strip width of 75 meters is equal for both ICAO code E and code F. Landing (under VFR) of an A380 in this case may not restrict the use of the parallel taxiway for aircraft with a wingspan of less than 65 meters. No specific procedures are required.*
- b) Landing of an A380 on an instrument runway, Runway – taxiway separation is 182.5 meters,
The runway – taxiway separation is based on a half runway strip width of 150 meters plus half the wingspan of the aircraft on the parallel taxiway. The half runway strip width of 150 meters is equal for both ICAO code E and code F. Landing of an A380 in this case will not restrict the use of the parallel taxiway for aircraft with a wingspan of less than 65 meters. No specific procedures are required*
- c) Take-off of an A380, runway – taxiway separation is 107.5 meters,
For the take-off case, the half runway strip width equals 75 meters plus half the wingspan of the aircraft on the parallel taxiway. The half runway strip width of 75 meters is equal for both ICAO code E and code F. Take-off of an A380 may not restrict the use of the parallel taxiway for aircraft with a wingspan of less than 65 meters. No specific procedures are required*
- d) Take-off of an A380, runway – taxiway separation is 182.5 meters,
For the take-off case, the half runway strip is 75 meters plus half the wingspan of the aircraft on the parallel taxiway. The half runway strip half-width of 75 meters is equal for both ICAO code E and code F. Take-off of an A380 will not restrict the use of the parallel taxiway even not for A380 aircraft. No specific procedures are required.*
- e) Taxiing of an A380 on a parallel taxiway, runway – taxiway separation is 107.5 meters,*



The A380 wingtip will infringe the runway strip with a distance of 7.5 meters. Operations on the runway should therefore temporarily be halted until the A380 has left the parallel taxiway.

- f) *Taxiing of an A380 on a parallel taxiway, runway – taxiway separation is 182.5 meters,*

The A380 wingtip will infringe the runway strip with a distance of 7.5 meters². Take-off operations can be operated as normal but instrument landings may temporarily be halted until the A380 has left the parallel taxiway. Non instrument landings however could be operated normally

From the above it can be concluded that the critical point is not the operation of an A380 on the runway, but rather the operation of an A380 on the parallel taxiway.

[Comment: in annex 14, the width of the runway strip is a permanent characteristic attached to the runway, not to the type of operations and the aircraft size. It may be necessary to note that proposals b, d, and f consist in saying that an instrument runway in visual conditions can be operated with the clearances of a non-instrument runway, with an acceptable level of safety. In practice, this may need to be validated by ATC services]

Recommended alternative measures, operational procedures and operating restrictions for airports that cannot comply with taxiway separation according to TWY-RWY.

Cali International Airport has in consideration the following alternatives:

- When an A380 or similar Code F aircraft operates on the runway, TWY A operation will be restricted.
- When an A380 or similar Code F aircraft operates on TWY A, RWY operation will be restricted.

3.4 Obstacle Free Zone

² For an A380 taxiing on a code E parallel taxiway, the distance from runway centerline to the A380 wingtip is 142.5m. With respect to FAA requirements, for a 747-400 taxiing on a Group V parallel taxiway, the distance from runway centerline to the 747 wingtip is only 122m.



The Obstacle Free Zone protects the airspace above the inner approach surface, the inner transitional surfaces, the balked landing surface and that portion of the strip bounded by these surfaces. Any fixed obstacle other than a low mass may not penetrate the OFZ and frangible mounted one required.

The width of the lower surface of the OFZ is 120 meters for code E (and lower) aircraft. For code, F ICAO to be 155 meters specifies aircraft the width of the lower surface. The justification used is that not only the wingspan is 20 meters larger (on initial code E 60 meters) but also the runway width is 15 meters larger (60 meters code E).

***[DR 5]** indicate ICAO OCP (Obstacle Clearance Panel) Balked Landing Study is expected to reduce this value³. It should be noted that France has already made an Aeronautical Study showing that an inner approach surface width of 133m for A380 operations will provide the same level of safety than for current B747-400 operations at existing Code E runways.*

ICAO Annex 14 Requirement: Width of lower edge 155 meters. Slope internal transition surface applicable to precision approach runways.

The Obstacle Free Zone (OFZ) protects the airspace above the inner approach surface, the inner transitional surfaces, the balked landing surface and that portion of the strip bounded by these surfaces. Any fixed obstacle other than a low mass may not penetrate the OFZ and frangible mounted one required.

As soon as Aerocali has knowledge of a code F aircraft operation, it shall inform the Air Navigation Group to take appropriate action in connection with airport approach procedures.

Alternative measures, procedures and operational restrictions proposed in tracks with relation to the OFZ.

- Document **[DR10]** informs Colombia Civil Aeronautics evaluated Cali airport OFZ for code F aircraft with Air Navigation Group and the Civil Aeronautics Operational Department.
- Before a code F aircraft operation, Aerocali will coordinate all operations details with Air Navigation Group, SEI, airline, handling company, airport security and SMS office.
- Timely information related to a Code F aircraft operation at the airport shall be taken into consideration.



3.5 Runway Holding Positions

Runway holding positions have two purposes, collision prevention and protection of the ILS signal.

- a) For collision risks, the biggest aircraft that can use the runway as well as the geometry of the aircraft at the holding position will determine the distance between runway holding point and runway centerline.*
- b) The other purpose is to prevent unacceptable interference with the ILS signal. During ILS CAT II/III operations, the runway holding positions needs to be positioned in such a way that the critical and the sensitive areas are free of any aircraft movement on the ground.*

For code, E the minimum distance for the runway, holding position is 90 meters, for code F this distance is 107.5 meters. These distances are based on

“an assumed aircraft with a tail specific height (code E; 20 meters, code F; 24 meters), a distance from nose to the highest part of the tail (code E; 52.7 meters, code F; 62.2 meters) and a nose height (both code E and F; 10 meters) holding at an angle of 45° or more with respect to the runway center line, being clear of the obstacle free zone (OFZ)”.

As can be concluded from above the Runway Holding Position is not only a function of the size of the Holding aircraft, but also of the dimensions of the Obstacle Free Zone (OFZ).

According with Numeral 3.3 and taking into consideration that the Alfonso Bonilla Aragón international airport is ILS CAT I, during the landing or take-off operation of an A-380 or similar code F aircraft, other aircraft must follow the following alternatives:

- When an A380 or similar Code F aircraft operates on RWY, TWY A operation will be restricted.
- When an A380 or similar Code F aircraft operates on TWY A, RWY operation will be restricted.

Alternative measures, procedures and operational restrictions proposed at airports that do not comply ICAO requirements related with waiting points distance.

Alfonso Bonilla Aragón International Airport takes into consideration the following alternatives:



- When an A380 or similar Code F aircraft operates on RWY, TWY A operation will be restricted.
- When an A380 or similar Code F aircraft operates on TWY A, RWY operation will be restricted.
- Appropriate ATC procedures were carried out in coordination with the Regional Air Navigation Group.

3.6 Taxiway minimum separation distances

Taxiway centerline to object

ICAO Annex 14: 57.5 meters.

AACG in **[DR 4]** recommends a distance of 51 meters if there is adequate guidance.

ICAO establishes smaller separations in parking access roads because there are smaller deviations in these taxiways. However, the studies carried out did not find any relation between taxi speeds and taxiway deviations.

AACG indicates **[DR 5]** that taxiway separations could be allowed to be inferior to ICAOs by applying appropriate measures such as pilot-guided, reduced taxiing speeds and publication of warnings in the AIP. If there is adequate guidance, for example taxiway centerline lights, an A380 could be operated on an E-Code taxiway (47.5 m)

It is important to note that the airport Alfonso Bonilla Aragón complies with the requirement of Annex 14 of 57.5 meters between the taxiways and aircraft parking position.

Alternative measures, procedures and operational restrictions proposed at airports that do not comply ICAO requirements for separation between taxiway and object.

- A code F aircraft operation will have always a "FOLLOW ME" vehicle accompaniment and wing walkers.

Aircraft stand taxi lane to object



Requirement Annex 14: 50.5 meters.

AACG in **[DR 4]** recommends a distance of 47.5 m, if there is adequate guidance.

In case of not having a distance of 50.5 m or 47.5 m, it should be used a signaler or even a pay mover to tow the aircraft.

In case of an A-380 or similar code F aircraft operation Aerocali will coordinate with Air Navigation Group the following aircraft parking alternatives:

- **Alternative A.** On the guideline of the international ramp at front of positions D17 and D18. Coordinates: [03 32 03.36 N / 76 23 08.37 W](#)
- **Alternative B.** On the TWY G between cargo ramp and decongestion ramp. Coordinates: [03 32 25.15 N / 76 23 09.42 W](#)
- **Alternative C.** Position D19 if the handling company has an A-380 o similar code F aircraft. Coordinates: [03 32 05.35 N / 76 23 11.62 W](#)

Alternative measures, procedures and operational restrictions proposed at airports that do not meet the ICAO requirements relating to separation between access road to parking lot and object.

- For safety reasons, Cali airport have assigned for a code F aircraft operation double of wing walkers used for code E aircraft operation.
- A pay mover can be used if aircraft operator or handling companies have the appropriate equipment for a code F aircraft operation.
- This procedure was published in Colombia AIP with the guided of Civil Aeronautics Circular 031 **[DR10]** and in coordination with Air Navigation Group.

3.7 Aprons and aircraft stands.

Requirements Annex 14: 7.5 meters.

Compared to a B747-400, the A380 has a similar length and a wingspan of 15 meters higher.

Parking an A380 in a parking lot for B747 requires limiting the size of the aircraft to park in the adjacent parking lots. Another possibility is to use two parking lots.



In any case, the ICAO margins of 7.5 m should be guaranteed. Consideration should also be given to the use of signalers and even towing using a pay mover.

A pay mover can be used if aircraft operator or handling companies have the appropriate equipment for a code F aircraft operation. Otherwise, autonomous parking positions must be used exclusively.

In case of an A-380 or similar aircraft code F operation, Aerocali will coordinate with Air Navigation Group the following aircraft parking alternatives:

- **Alternative A.** On the guideline of international ramp at front of positions D17 and D18. Coordinates: 03 32 03.36 N / 76 23 08.37 W
- **Alternative B.** On the TWY G between cargo ramp and decongestion ramp. Coordinates: 03 32 25.15 N / 76 23 09.42 W
- **Alternative C.** Position D19 if aircraft operator/handling company has an A-380 or similar code F aircraft equipment. Coordinates: 03 32 05.35 N / 76 23 11.62 W

Alternative measures, procedures and operational restrictions proposed at airports that do not comply ICAO requirements for separation in the parking lot.

Alfonso Bonilla Aragón International Airport considered the following alternative measures:

- Temporary degradation of adjacent aircraft parking position.

In **Alternative A**, the D17 and D18 positions are degraded.

In **Alternative B**, the R3 and L1 positions are degraded.

In **Alternative C**, the G4, G5, D18 and D20 positions are degraded.

- Use of two aircraft parking positions.

Alternative A, (D17 and D18).

Alternative B, (R3 and L1).

Alternative C, (D18 and D19).

- Autonomous aircraft parking position.

Alternative A (D17 and D18).

Alternative B (R3 and L1).



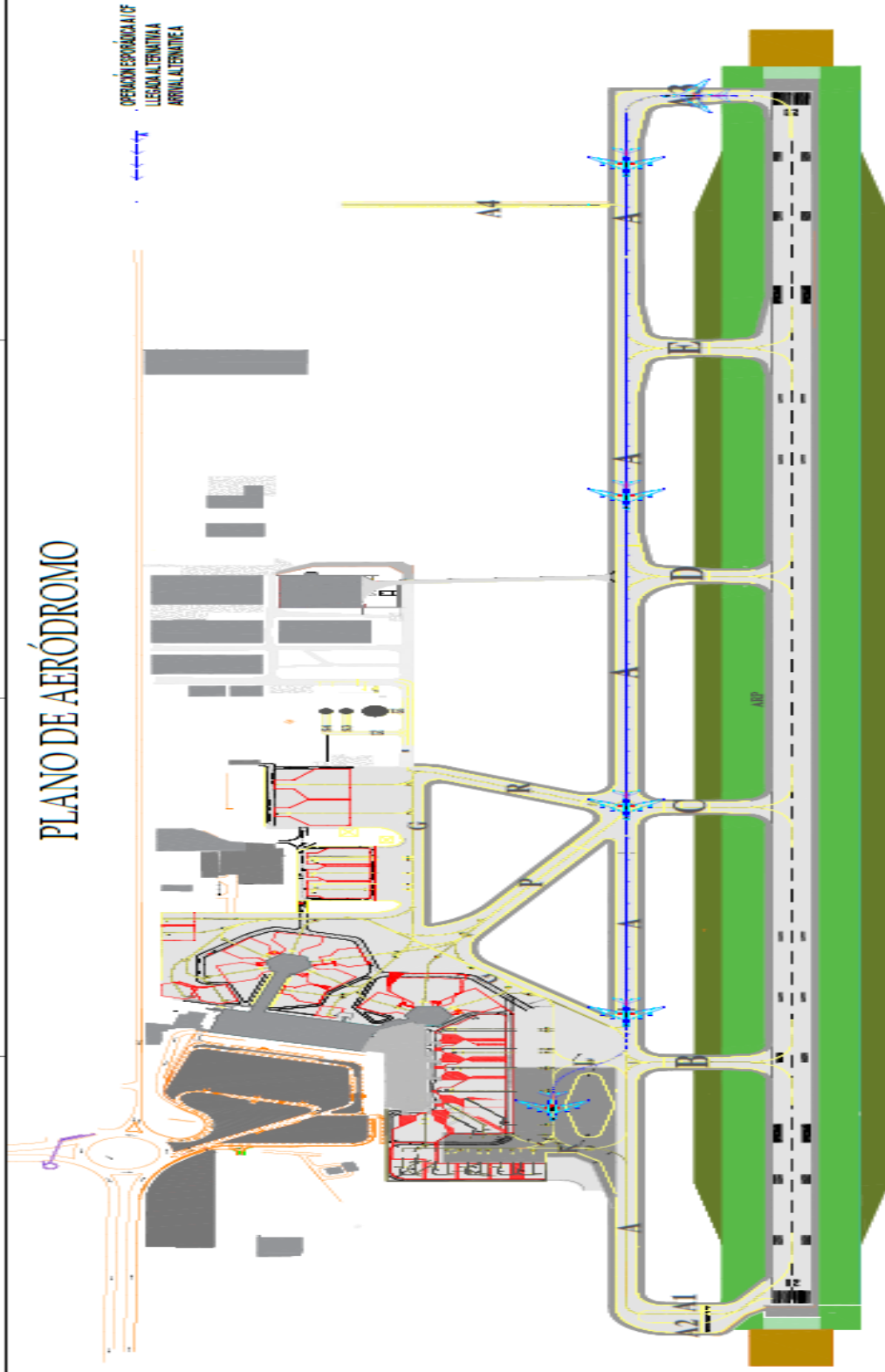
- A-380 or similar code F aircraft alternatives parking positions were published in Colombia AIP.

3.8 Taxi routing

A380 or similar code F aircraft arrival route. Aerocali in coordination with ATC has defined RWR 02 CAT I as the approach RWY. After landing, the following route alternatives will be considered:

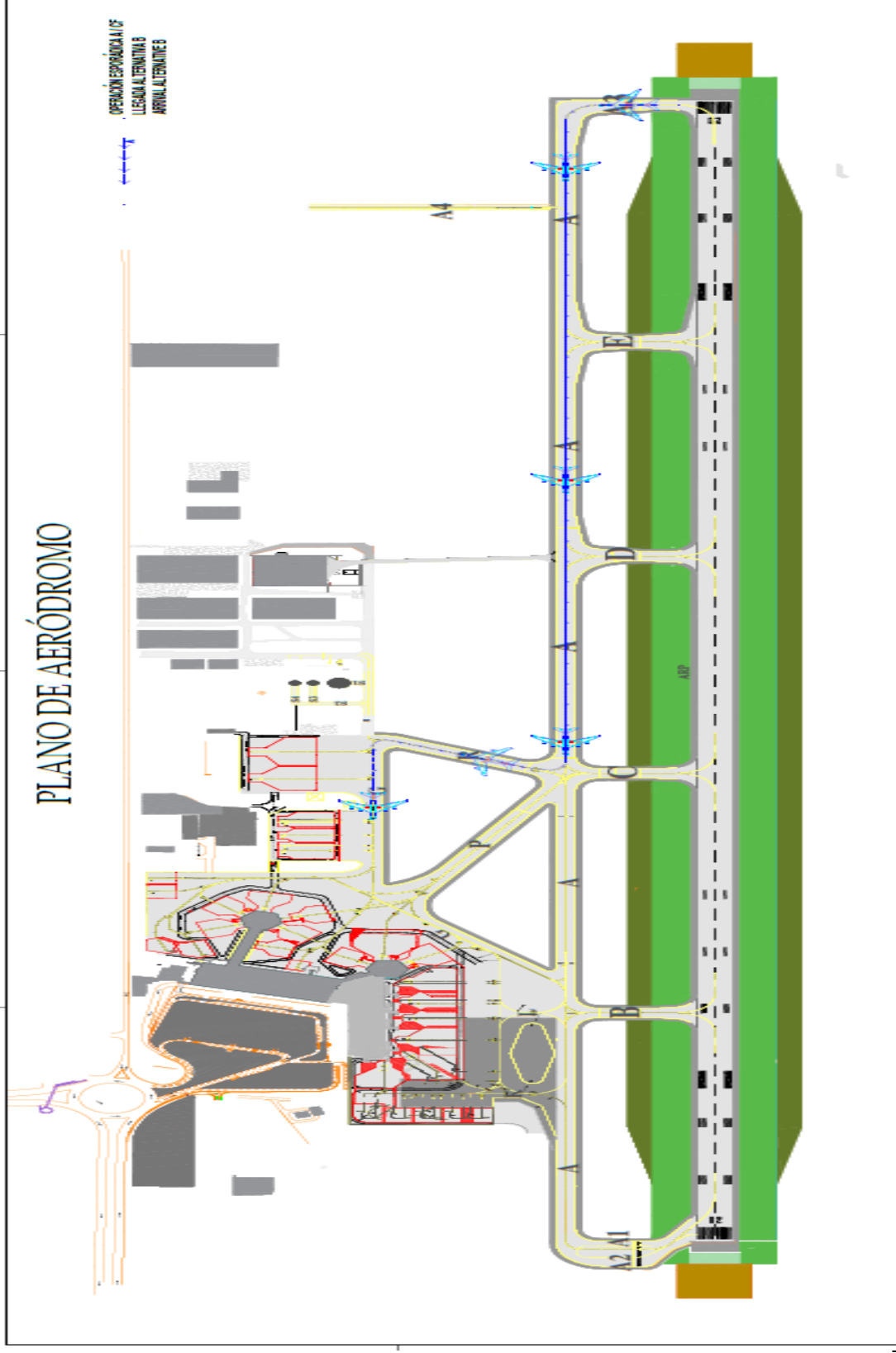
Alternative An arrival: Any Code-F aircraft will exit by RWY 20 via TWY A to interception of TWY A and TWY G. It will make a right turn on TWY G into (T2) ramp to park parallel to T-2 terminal. The aircraft will park in front of positions D17 and D18. It means that positions D17 and D18 will be temporarily out of service. The aircraft will park exactly on the coordinates **03 32 03,36 N / 76 23 08,37 W.**

PLANO DE AERÓDROMO





Alternative B arrival: Code F aircraft will exit by RWY 20 via TWY A to interception of TWY C and TWY R. It will make a right turn via TWY R to TWY G. On TWY G, it will make a left turn to park on TWY G, between parking positions R3 and L1. It means positions R3 and L1 will be temporarily out of service. The aircraft will park exactly on the demarcation of the TWY G axis identified as R3, coordinates [03 32 25.15 N / 76 23 09.42 W](#).

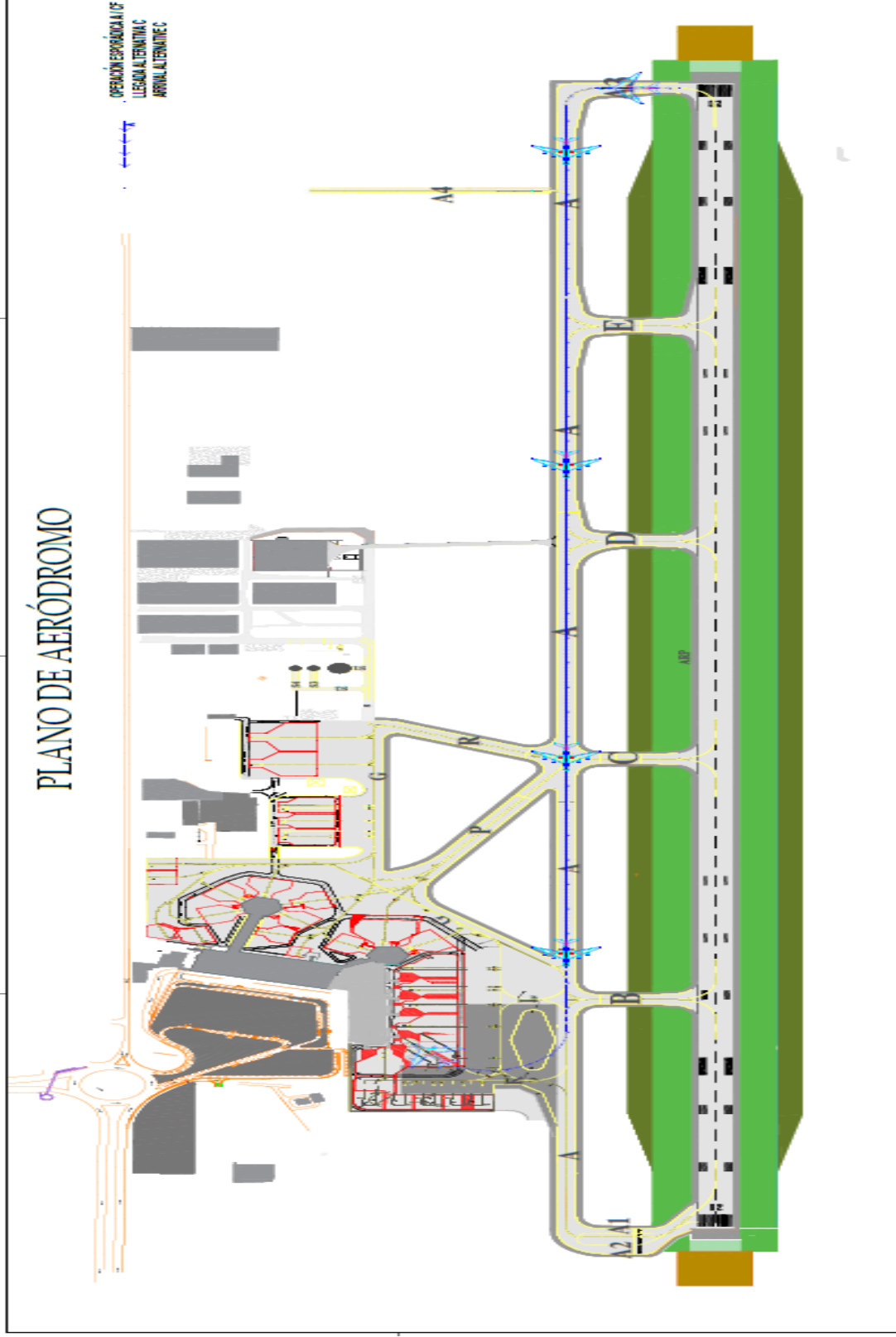




Alternative C arrival: In case any aircraft operator/handling company has A-380 or similar code F equipment available, the aircraft will exit by RWY 20 via TWY A to TWY K. It will make a right turn on TWY K into international ramp to gate D19. Positions G4, G5, D18 and D20 will be temporarily out of service. Coordinates **03 32 05.35 N / 76 23 11.62 W.**

As soon as the aircraft exit RWY, it will be accompanied by the FOLLOW ME vehicle to the gate. In addition, Alfonso Bonilla Airport will coordinate with aircraft operator/handling company to have double wing walkers that usually are assigned to an E code aircraft operation.

PLANO DE AERÓDROMO



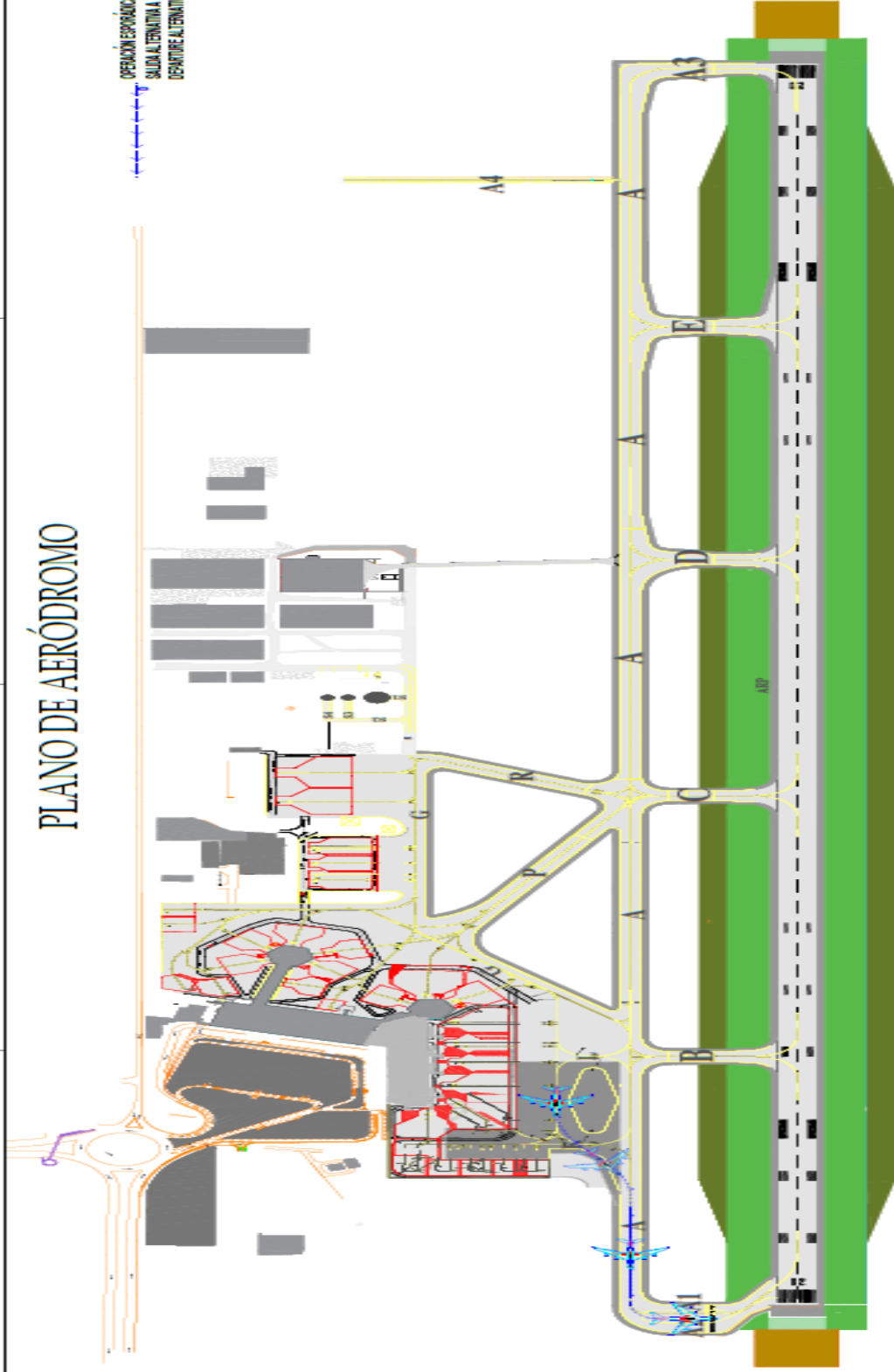


Exit route. RWY 02 has been assigned by ATC as the takeoff RWY.

Alternative A departure: The aircraft will start two engines at the spot No. 09, (front axis line T-2 between positions D17 and D18 and it will exit by TWY K to TWY A, where it will continue exclusively by TWY A to RWY 02 waiting point.

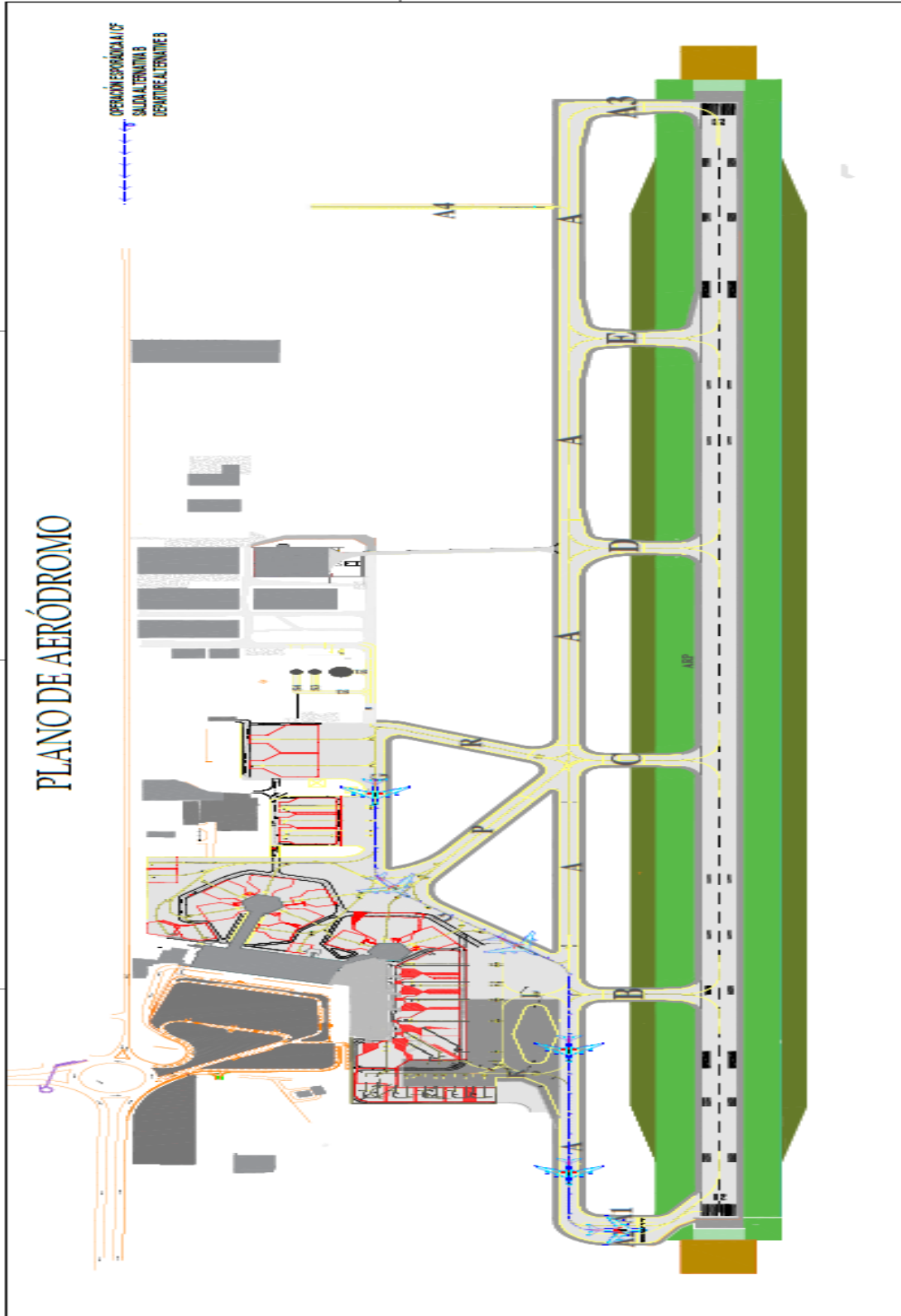
PLANO DE AERÓDROMO

OPERACIÓN ESPECIAL A/C
SALIDA ALTERNATIVA
DEPARTAMENTO ALTERNATIVA





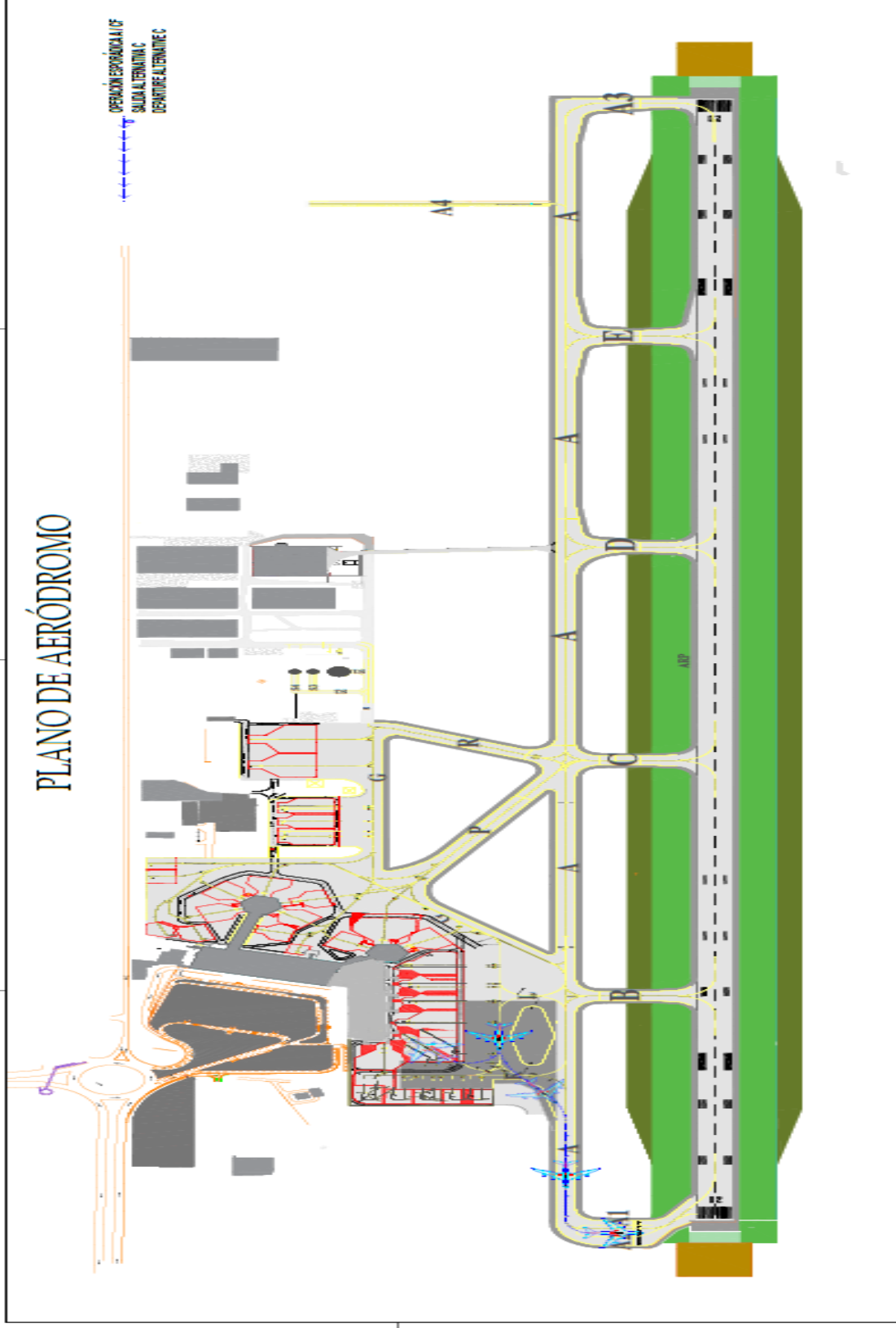
Alternative B departure: The aircraft will start two engines at the parking spot (TWY G) and it will exit by TWY G to TWY A, where it will continue exclusively by TWY A to RWY 02 waiting point.





Alternative C Departure: The aircraft must push back to engines starting point number 09. It will start two engines and it will exit by TWY K to TWY A. It will continue exclusively by TWY A to RWY 02 waiting point.

- Code F aircraft operation always will have the accompaniment of a ramp inspector and airport duty manager-(CECOA) and will comply with the airport rules and regulations.
- CLO AIP had published Code F aircraft taxiway routes.





3.9 Emergency planning.

Airport Emergency Plan was reviewed in particular to include responses to the needs of code F aircraft operation. Especially regarding access to the upper deck and evacuation of disabled persons. Aerocali has provided to Alfonso Bonilla international Airport's SEI personnel with A-380 and B-747-8 aircraft characteristics, in particular evacuation carts.

In any case, Aerocali will contact aircraft operator that operates code F aircraft regarding particularities of B747-8/A380 aircraft and their own procedures.

- Technical information was obtained from B747-8/A380 aircraft (Evacuation letters - crash-cart) and it was delivered to SEI and Air Navigation Group.
- Code F aircraft characteristics were given to airport SEI and Air Navigation Group.
- Airport Emergency Plan was adjusted with code F aircraft characteristics.

3.10 S.E.I.

Code F aircraft sporadic operation is similar to any other code E aircraft. Alfonso Bonilla airport's SEI is ICAO CAT VIII. In any case, once the Aeronautical Authority knows about a possible Code F operation, it will notify Aerocali. Aerocali will coordinate with SEI in order to level CAT VIII to CAT X.

Alfonso Bonilla Aragón airport's SEI staff has already A-380 and B-747-8 characteristics information.

Consequently, no alternative measures, procedures or operational restrictions are proposed in relation to the category of SEI.

- Cali airport SEI has A-380 and B-747-8 aircraft characteristics' information- (Crash Chart).

3.11 Aircraft Recovery Plan



Alfonso Bonilla International Airports' Aircraft Recovery Plan and Aircraft Recovery Committee had been updated with code F aircraft's characteristics. In case of any aircraft recovery event, especial coordination had been make with the Aircraft Recovery Committee. Similar code E aircraft recovery procedures will be apply.

3.12 Ground handling.

In the event of an A-380 or similar code F aircraft operation, Aerocali will coordinate with ground handling agent's appropriate equipment for ramp operation:

- Passengers stairs.
- Luggage and cargo equipment.
- Pay mover and tow bar.
- Enough fueling equipment coordination.

Aerocali will assign twice as many wing walkers as are usually used for an E code aircraft.

4 Planning the operation.

As soon as Alfonso Bonilla Aragón international airport has information of a code F aircraft operation, Aerocali will coordinate operation planning for landing, taxiing, parking and ground handling until it takes off. Planning and coordination will be timely carried out with ATC, SEI, aircraft operator, handling company, airport operations, airport security, and SMS airport's department.

Airport SMS studies had considered mitigation measures and possible influences on other airport traffic. In addition, aircraft taxi routes were defined.

5 Conclusions.

At code 4E airports where sporadic code F aircraft operations are expected, it is clear that financially it will be difficult to fulfil the ICAO requirements.

However, this document provides a number of alternative measures, operational procedures and operating restrictions that can be implement to cope with the occasional movement of a code F aircraft without the burden of high investment cost and infrastructure changes.



In fact, this is a common practice at many airports in which aircraft operations are bigger than their design aircraft: For example, an An-124, or even B 747.

The set of measures, procedures and restrictions and possible modifications of infrastructure has been carefully considered by Aerocali in order to minimize the effect that a code F aircraft operation, such as an A380, B747-8, may have in Cali international airport.

Finally, it is important to note that code F aircraft operators have the responsibility to train their personnel and crew during sporadic operations at alternate airports. In addition, it is very important to provide the necessary documentation to ensure that the operation is performed as safely as possible.