APPENDIX 23

CWA ALTERNATE AIRPORT STUDY

/Cape Winelands Alternate Aerodrome Feasibility Study

Client: rsa.AERO Cape Winelands Airports (CWA)

Submission date: 26th April 2024

Table of Contents

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- Added work package 4 “Weather Analysis” for delivery to client.
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- Added work package 2 “South African Alternate Airport Evaluation”.
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Chapter 5

- Corrected elevations for Bloemfontein, Durban, George, OR Tambo Airport.
- Updated take-off performance calculations for these airports accordingly.
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Chapter 6

- Changed column Approach and Taxiway Lighting to be compliant with ICAO standards.
- Columns Ground Power Unit, Preconditioned Air Unit, Air Starter Unit: minor changes to implement latest plans.

Chapter 7

- Added legends for the colour codes of the 3D graphs for better understanding.

Miscellaneous:

- Minor editorial changes.

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This document and all included information are based on the information and circumstances which have been brought to our attention until 26th April 2024.

Abbreviations

Term	Meaning
ACI	Airport Council International
ACN	Aircraft Classification Number
APU	Auxiliary Power Unit
ASU	Air Starter Unit
AWOS	Automated Weather Observing System
AWW	Airport Weather Warning
BORPC	ICAO Air Basic Operational Requirements and Planning Criteria
CASA	Civil Aviation Safety Authority Australia
CONOPS	Concept of Operation
CPT	Cape Town International Airport
CT	Computer Tomography
CWA	Cape Winelands Airport
D-ATIS	Digital Automatic Terminal Information Service
DH	Decision Height for Instrument Approach
EASA	European Union Aviation Safety Agency
EDTO	Extended Diversion Time Operation
ERA	En-Route Alternate Aerodrome
ETA	Expected Time of Arrival
ETOPS	Extended-Range Twin-Engine Operations Performance
FAA	Federal Aviation Administration
FALS	Full Approach Lighting System
FEGP	Fixed Electrical Ground Power
FPFM	ICAO Flight Planning and Fuel Management Manual
Fuel ERA	Fuel En-Route Alternate Aerodrome
GNSS	Global Navigation Satellite System
GPU	Ground Power Units

GPU	Ground Power Unit
GSE	Ground Service Equipment
HHMD	Handheld Metal Detector
HIALS	Hight Intensity Approach Lighting System
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IRVR	Instrument Runway Visual Range
LED	Liquid Explosive Detection
MAI	Munich Airport International GmbH
METAR	Meteorological Aerodrome Report
MLAW	Maximum Landing Weight
MRO	Maintenance, Repair and Overhaul Services
MTOW	Maximum Take-Off Weight
NM	Nautical miles
PALS	Precision Approach Lighting System
PBB	Passenger Boarding Bridge
PCA	Pre-Conditioned-Air System
PCA	Preconditioned Air Unit
PCN	Pavement Classification Number
PTOW	Performance Limited Take-Off Weight
RFFS	Rescue and Fire Fighting Services
RNAV	Area Navigation: RNAV Approach based on GNSS
RNP	Required Navigation Performance
RVR	Runway Visual Range
SACAA	South African Civil Aviation Authority
SARPs	Standards and Recommended Practices
SRA	Security Restricted Area

STAR	Standard Arrival Route
TAF	Terminal Aerodrome Forecast
TMA	Terminal Area
TORA	Take-Off Run Available
TREND	Expected METAR weather changes in the next two hours
ULD	Unit Load Device
UPS	Uninterrupted Power Supply
VOR	VHF Omnidirectional Range
WTMD	Walkthrough Metal Detector

Executive Summary

Munich Airport International GmbH (MAI) was commissioned to analyse the general suitability of Cape Winelands Airport (CWA) as a destination alternate aerodrome for Cape Town International Airport (CPT) as part of this study.
The study begins by outlining the legal requirements and industry best practices that govern the planning of alternate airports. The different types of alternates that CWA could serve as are identified: take-off alternate, en-route alternate, fuel en-route alternate and destination alternate. When analysing the potential fuel savings for airlines when selecting CWA as an alternate aerodrome, it becomes clear that the use case of the destination alternate aerodrome should be pursued above all. Additionally, the use case as fuel en-route alternate seems to be beneficial as well. In the following, the requirements for airports to be planned as an alternate airport are shown to be able to check the suitability of CWA against these later on. In addition to the legal requirements, the selection of alternates by airlines is also taken into account, in the context of which three categories of airports are defined: basic, planning and operational aerodrome, whereby an operational aerodrome can offer the most extensive services in the event of a diversion. As many airlines require operational aerodromes for the planning of alternates, MAI recommends positioning CWA as an operational aerodrome.

This study therefore analyses whether the current plans for the future CWA airport in accordance with the airport master plan planning phase PAL 1A meet the requirements of an operational aerodrome. **The study carried out confirms that the plans for CWA allow the conclusion that CWA will be classified as an operational aerodrome by airlines, meeting all requirements of an operational aerodrome**.

With the aim of identifying the position of CWA in competition with the already existing destination alternate aerodromes for CPT, six South African airports (Bloemfontein, Durban, George, OR Tambo, Port Elizabeth, CWA) were examined for their suitability as destination alternates for CPT. Military airports have not been considered within this study, as they may not be nominated as alternate aerodromes in South Africa. Considering different criteria (aircraft performance, apron/taxiway strength, operating hours, ground handling services, fuel services, maintenance services, passenger services, fire fighting and rescue services, runway approach lighting, instrument landing system, air traffic control services, space on aprons, and meteorological facilities), it was found that competition is rather low.
Besides CWA, only two South African airports provide a suitable destination alternate aerodrome for CPT: Durban and OR Tambo Airport are able to handle all aircraft types flying to CPT. However, the high elevation of OR Tambo Airport means that certain types of aircraft cannot take off with their maximum take-off weight.
CWA's master plan is also considered in this study and fulfills all the requirements to be able to function as a destination alternate aerodrome for all aircraft types flying to CPT. Considering the significant fuel saving for airlines, which result from planning CWA as destination alternate aerodrome for CPT, MAI comes to the conclusion that CWA could be the preferred destination alternate for CPT in the future.

Within a weather analysis, MAI has analysed the suitability of CWA as a destination alternate aerodrome for CPT on the basis of weather data from the last 20 years. At first, it was shown that the applicable pre-flight planning minima for CWA as a destination alternate depend on the respective regulation of the aircraft operator. For CWA, a distinction can be made between EASA, FAA, CASA, and ICAO based pre-flight planning minima when considering the long-haul flights arriving at CPT. Depending on the aerodrome approach capability at CWA, this results in different pre-flight planning minima, which lead to different times per year when the weather in CWA is below these pre-flight planning minima, which means that CWA cannot be specified a destination alternate. Considering the actual arrival times for CPT, the weather analysis shows the following results, considering two cases. ILS Cat 1 and ILS Cat 3 approach available at CWA:

- Assuming the availability of an ILS Cat 1 approach at CWA, the probability of weather events preventing the planning of CWA as a destination alternate averages **4.34%** per year, considering the actual CPT timetable.
- Assuming the availability of an ILS Cat 3 approach at CWA, the probability of weather events preventing the planning of CWA as a destination alternate averages **4.27%** per year considering the actual CPT timetable.
- The numbers above lead to the recommendation of MAI, that the establishment of an ILS Cat 1 approach at CWA is sufficient for the intended use as destination alternate aerodrome to CPT. There is no need to plan for an ILS Cat 3 approach system, which both has significant higher capital and operational expenditures.
- The results of the weather analysis indicate that CWA is very well suited to serve as a destination alternate. Regarding the weather situation, it is expected that CWA can be planned as the destination alternate aerodrome for CPT during **95,66%** of the annual operating time. Compared to other destination alternate aerodromes over the world, this is a remarkably high availability.

Finally, some of the most important macro processes that are required in a diversion scenario in CWA are shown. In addition to the high-level process description at process mapping level L1 (macro processes), technical and functional requirements as well as roles and responsibilities are outlined. They can serve as a basis for detailed operational planning and the development of a CONOPS for CWA airport.

1.0 Introduction to Alternate Aerodrome Planning

1.1 Preface

In the dynamic field of commercial aviation, accurate planning is essential to ensure safe and efficient operations. Among the many considerations airlines need to cater for, alternate aerodrome planning stands as a critical aspect in ensuring safe, efficient, and resilient flight operations. Alternate aerodrome planning refers to the process by which airlines identify, evaluate, and define diversion aerodromes to be utilized in cases of unforeseen circumstances or operational disruptions at the primary destination or during the en-route phase of flight.

The need for alternate aerodrome planning arises from the recognition of the inherent unpredictability within flight operations. Despite advances in technology and operational efficiency, numerous factors beyond an airline's control can arise, ranging from adverse weather conditions and air traffic congestion to mechanical issues or runway closures, which call for alternate plans, that need to be carefully prepared before every single flight. Alternate aerodrome planning therefore needs to comply with the following key considerations:

- Operational Resilience: Alternate aerodrome planning enhances the operational resilience of airlines by providing fallback options in the event of disruptions during the en-route phase of a flight or at the destination aerodrome. By having alternate aerodromes strategically identified and prepared, airlines can minimize the impact of unforeseen events on flight schedules and passengers.
- Safety and Security: The safety and security of passengers and crew are paramount considerations for airlines. Planning for alternate aerodromes ensures that in emergencies or situations where the primary destination becomes inaccessible, there are designated landing sites meeting safety standards and that are equipped with necessary facilities to handle diversions.
- Regulatory Compliance: Aviation authorities mandate that airlines have plans in place for diversions to alternate aerodromes as part of regulatory requirements. Compliance with these regulations is essential for maintaining operational licenses and ensuring adherence to safety standards.
- Customer Experience: Unplanned diversions can be stressful and inconvenient for passengers. By proactively planning for alternate aerodromes, airlines can minimize disruptions, provide timely information to passengers, and facilitate smoother transitions during diversions, thereby enhancing the overall customer experience.
- Fuel and Resource Management: Diversions to alternate aerodromes may require additional fuel and resources. By incorporating alternate airport planning into their operational strategies, airlines can optimize fuel management, ensure resource availability at designated diversion sites, and mitigate financial implications associated with unplanned diversions.

Alternate aerodrome planning by airlines is not only a strategic consideration but also a regulatory obligation governed by stringent requirements aimed at ensuring the safety, reliability, and effectiveness of flight operations. By adhering to these regulations, airlines can enhance operational resilience, mitigate risks, and uphold the high standards of today's commercial aviation industry.

An alternate aerodrome is defined by ICAO as an aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or land at the aerodrome of intended landing. Furthermore, the aircraft performance requirements can be met at the alternate aerodrome, which is operational at the expected time of use, and where the necessary services and facilities such as air traffic services, appropriate lighting, communications, meteorological reporting, navigation aids and emergency services are available.
Alternate aerodromes are not limited to serve as an alternate to the planned destination aerodrome only, but can as well serve as take-off alternate aerodrome, en-route alternate aerodrome, and fuel en-route alternate aerodrome, as outlined in the following chapters.

1.2 Introduction to Pre-Flight Fuel Requirements for Commercial Flights

To better understand the different concepts of alternate aerodrome planning, a brief introduction to fuel planning for commercial flights is needed.
The guidelines for fuel planning are derived from the Flight Planning and Fuel Management (FPFM) Manual from ICAO and have been translated to national legislation in most countries. It states that a flight shall not be commenced or continued in the case of in-flight replanning (diversion), unless the commander is satisfied that the aircraft carries at least the amount of fuel to complete the flight safely, taking into account the expected operating conditions and to allow for deviations from the planned operation. To fulfil this requirement, the commander of a flight needs to ensure that the aircraft carries at least the sum of the following fuel components before engine start at the departure aerodrome:

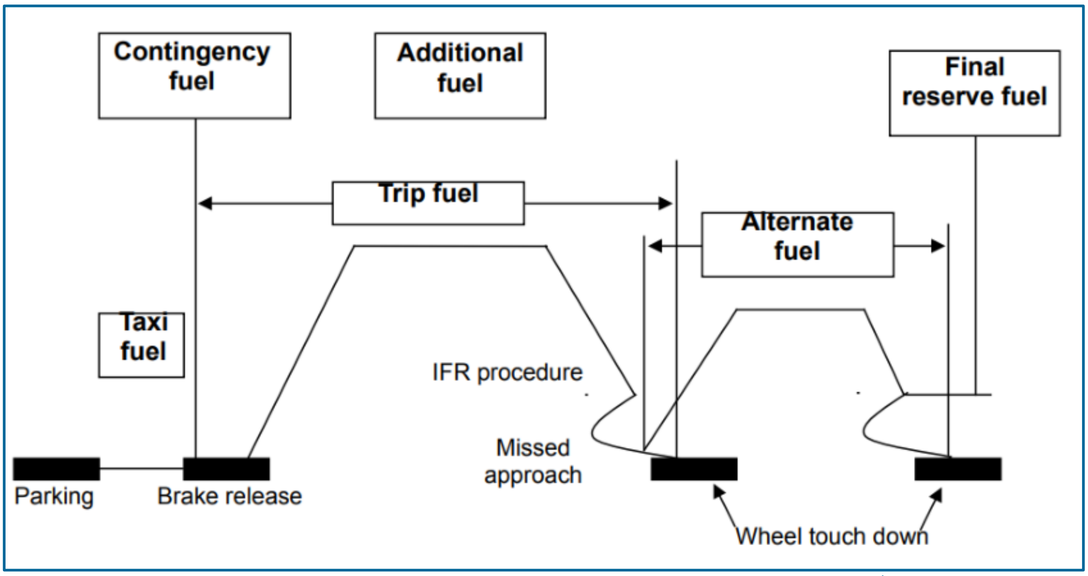


Figure 1 Pre-Flight Fuel Requirements for Commercial Flights[1]

- Taxi fuel: Taxi fuel refers to the amount of fuel consumed by an aircraft before take-off, including auxiliary power unit (APU) usage, engine start procedures, and the actual taxiing phase. Typically, taxi fuel is a predetermined quantity based on an average taxi duration. However, local conditions at the departure aerodrome such as average taxi time, normal ground delays and any anticipated de-icing delays should be taken into consideration and the taxi fuel adjusted accordingly.
- Trip fuel: Trip fuel is the fuel required from brake release at take-off at the departure aerodrome to touchdown at the destination aerodrome. It needs to include fuel for the take-off procedure, fuel for the climb to the cruising flight level, fuel for the flight in level cruise including any step climbs, fuel for the descent and approach, as well as fuel for the landing procedure.
- Contingency fuel is carried to compensate for any unforeseen factors that could negatively influence the fuel consumption to the destination aerodrome. This could be deviations from meteorological forecasted conditions, or the planned flight

[1] Reference: own illustration based on ICAO Annex 6 Operation of Aircraft Part I, 11th Edition, 2018

routing, ATC restrictions, or blocked cruising flight levels. The amount of contingency fuel to be carried is usually the lower of:
  - 3% of the planned trip fuel provided a fuel en-route alternate aerodrome is available, or
  - 5 % of the planned trip fuel in case no fuel en-route alternate aerodrome is available, or
  - an amount of fuel sufficient for 20 minutes flying time based on the forecasted trip fuel consumption.
  - However, the contingency fuel may not be lower than the amount of fuel required to fly for five minutes at holding speed in 1,500 ft above the destination aerodrome.
  - Usually, the 3% case with the designation of a fuel en-route alternate aerodrome is governing.
- Contingency Fuel (FAA): In contrast to the above stated definition, FAA defines the amount of fuel to be uplifted which would be equal to the contingency fuel, to allow to fly for 10% of the total time required to fly from the departure aerodrome to the aerodrome of intended landing.
- Alternate fuel is the amount of fuel required from the start of the missed approach procedure at the destination aerodrome until landing at the specified destination alternate aerodrome. It takes into account the fuel required for the missed approach procedure, the fuel to climb to the diversion cruising altitude, the fuel required for the cruise and descent, as well as the fuel for the approach and landing at the destination alternate aerodrome.
- Final reserve fuel: Final reserve fuel is the minimum fuel required to fly for 30 minutes at 1,500 feet above the destination alternate aerodrome or, if a destination alternate is not required, at the destination aerodrome at holding speed in ISA conditions.
- Additional fuel might be required for special operation flights, including the following two cases:
  - EDTO flight: Additional fuel might be required to satisfy the requirement to reach an en-route alternate aerodrome within the specified Extended Diversion Time Operation (EDTO) diversion distance from every point along the intended flight route operated under the rules of EDTO operation, considering the event of an engine failure, a rapid decompression or a combination of both, whichever is the more critical case.
  - Non-EDTO flight: Additional fuel might be required to satisfy the requirement to reach an en-route alternate aerodrome within 60 minutes of flying time with the one engine inoperative cruising speed from every point along the intended flight route.

- Discretionary fuel is carried on the sole discretion of the flight crew if deemed necessary. Discretionary fuel is a strategic instrument used by flight crews to account for adverse meteorological conditions at the destination aerodrome or during the en-route phase of flight, which are still within the regulatory limits but might pose threats on the intended operation. Other reasons for carrying discretionary fuel include expected delays at the departure or arrival aerodrome or previous experience of over-burn of fuel.[2]

[2] Chapter references:
- ICAO Doc 9976 Flight Planning and Fuel Management (FPFM) Manual, 1st Edition, 2015
- EASA Rules for Air operations (Regulation EU No. 965/2012) Annex IV Part-CAT Subpart B: Operating Procedures, 29th September 2023
- FAA: 14 CFR § 121.645 Fuel supply

1.3 Take-Off Alternate Aerodrome

An aircraft operator is required to specify a take-off alternate aerodrome in its operational flight plan if it would not be possible to return to the aerodrome of departure shortly after take-off due to meteorological reasons or other reasons.
If a technical failure, a medical emergency, unruly passenger, urgent operational airline requirements or any other reasons require an immediate re-landing shortly after take-off, the first choice of aircraft operators and flight crews usually is to return to the aerodrome of departure. In case the meteorological conditions at the departure aerodrome are below the applicable landing minima, or the aircraft is not able to return to the departure aerodrome due to performance reasons or any other reasons, an aircraft operator needs to define a take-off alternate aerodrome in its operational flight plan. Considering performance reasons, the aircraft operator is required to consider the failure of one engine (critical engine) for the immediate re-landing. Other reasons could include but are not limited to blocked or shortened runways, maintenance or failure of navigational aids or approach lighting systems, or failures of air traffic control systems.

- For aeroplanes with two engines, a take-off alternate aerodrome must be within one hour's flight time at the one-engine-inoperative cruising speed (also known as threshold distance) specified in the aircraft flight manual and assuming the aircraft mass is the actual mass at take-off and ISA and still-air conditions prevail.
    - Typical values for the threshold distance are:
        - A320 family: around 375 NM
        - A330/350: around 425 NM
        - B777/787: around 430 NM
- For EDTO certified two-engine aircraft and flight crews, a take-off alternate aerodrome needs to be located within two hour’s flight time at the one-engine-inoperative cruising speed specified in the aircraft flight manual and assuming the aircraft mass is the actual mass at take-off and ISA and still-air conditions prevail, if the aircraft has not been dispatched with EDTO operation relevant inoperative technical systems according to the minimum equipment list.
    - Typical values for the EDTO threshold distance are:
        - A320 family, if EDTO certified: around 700 NM
        - A330/350: around 850 NM
        - B777/787: around 860 NM
- Aeroplanes with three or more engines are permitted two hours of flight time for the same purpose and under the same conditions as outlined above.

An aerodrome may not be designated as a take-off alternate aerodrome unless the available information indicates that at the estimated time of potential use, the prevailing conditions will be at or above the applicable operating minima.

Implications of a take-off alternate aerodrome on fuel planning and fuel consumption:

The designation of a take-off alternate aerodrome usually does not have any effect on fuel planning since it is required to be located within close proximity to the departure aerodrome. Therefore, the planned trip fuel is usually sufficient to reach the take-off alternate aerodrome. The destination aerodrome might as well be designated as the take-off alternate aerodrome.
This leads to the conclusion that the establishment of a closely located take-off alternate aerodrome does not result in any fuel savings for aircraft operators.[3]

[3] Chapter references:

- ICAO Doc 4444 Procedures for Air Navigation Services: Air Traffic Management, 16th Edition, 2016
- ICAO Doc 9981 Procedures for Air Navigation Services: Aerodromes, 3rd Edition, 2020
- ICAO Doc 8168 Procedures for Air Navigation Services: Aircraft Operations, 6th Edition, 2018

1.4 En-Route Alternate (ERA) Aerodrome

An aircraft operator is required to ensure that an adequate aerodrome at which an aircraft can be safely operated, is located not further away than 60 minutes of flying time at the one-engine-inoperative cruising speed in still air conditions from every single point on the intended flight route.

> An adequate aerodrome in this context is considered to be an aerodrome at which the aircraft can be safely operated, taking into account the performance requirements and the runway characteristics, as well as the availability of the aerodrome at the expected time of use. The aerodrome should further be equipped with the required air traffic services, communication systems, meteorological reporting, navigation aids, sufficient lighting and emergency services.

On certain flight routes, aircraft operators are not able to comply with the requirement for an en-route alternate aerodrome within 60 minutes of flying time as outlined above. Historically, twin-engine aircraft were restricted from flying these routes due to concerns about engine reliability and the ability to reach an adequate aerodrome in case of an engine failure. Since, engine reliability has greatly increased, regulations have been changed, to enable twin-engine aircraft to be operated further than 60 minutes away from an adequate aerodrome. This has been introduced under a concept called Extended Diversion Time Operations (EDTO), formerly known as Extended Twin-Engine Operations (ETOPS). EDTO flights are subject to a process of explicit approval which, has both aeroplane type design and aeroplane operational requirements.
For EDTO flights, an aircraft operator needs to specify one or more en-route alternate aerodromes for use in the event of a diversion during an EDTO flight. This aerodrome has to be located within the approved EDTO maximum diversion distance from every point on the EDTO portion of the flight route. As for normal en-route alternate aerodromes, the EDTO en-route alternate has to be an adequate aerodrome but needs to fulfil more stringent weather minima requirements at dispatch of flight. However, these weather minima requirements apply only to the flight planning stage and do not limit the authority of the pilot-in-command during the flight

> Implications of en-route alternate aerodromes on fuel planning and fuel consumption:
> The availability of en-route alternate aerodromes have a significant influence on flight route planning and therefore directly effects the fuel consumption of aircraft. As aircraft operators need to satisfy the requirement of an ERA aerodrome within 60 minutes of flying time at the one-engine-inoperative cruising speed, the availability of ERA aerodromes effects route planning. Sufficient availability of ERA aerodromes therefore allows for more direct (shorter) flight routes, translating to a lower amount of trip fuel and contingency fuel required.[4]

[4] Chapter references:
- ICAO Doc 4444 Procedures for Air Navigation Services: Air Traffic Management, 16th Edition, 2016
- ICAO Doc 9981 Procedures for Air Navigation Services: Aerodromes, 3rd Edition, 2020
- ICAO Doc 8168 Procedures for Air Navigation Services: Aircraft Operations, 6th Edition, 2018

1.5 Fuel En-Route Alternate (Fuel ERA) Aerodrome

The introduction of a fuel en-route alternate aerodrome is a concept which aims at reducing the amount of contingency fuel an aircraft operator is required to have on board after engine start. As addressed in chapter 1.2 Introduction to Pre-Flight Fuel Requirements for Commercial Flights, the required amount of contingency fuel can be reduced to 3% of the trip fuel in case a fuel ERA aerodrome is available. For this purpose, a fuel ERA shall be specified, which needs to be located within a circle having a radius equal to 20% of the total flight plan distance, the centre of which lies on the planned route at a distance from the destination aerodrome of 25% of the total flight plan distance, or at least 20% of the total flight plan distance plus 50NM, whichever is greater. All distances are to be calculated in still air conditions.

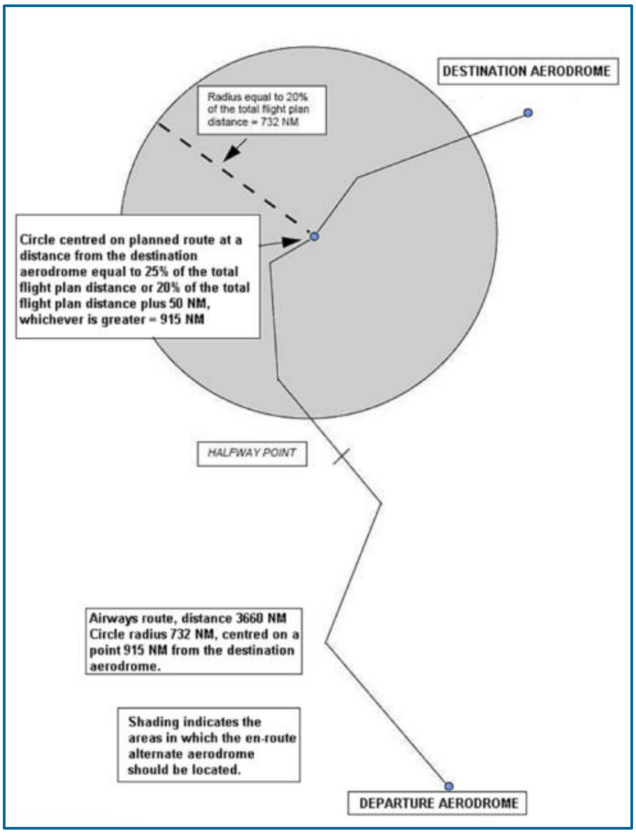


Figure 2 Location of Fuel ERA Aerodrome[5]

<u>Implications of fuel en-route alternate aerodromes on fuel planning and fuel consumption:</u>

The availability of a fuel ERA aerodrome has a significant influence on flight route planning and therefore directly effects the fuel consumption of aircraft. On the one hand, sufficiently available aerodromes which could be used as a fuel ERA for a flight, allow for more direct (shorter) flight routes. On the other hand, the designation of a fuel ERA allows to reduce the contingency fuel to 3% of the trip fuel. Compared to a flight planning scenario, where no fuel ERA is available, the

[5] Reference: European Union Aviation Safety Agency AMC2 CAT.OP.MPA.150 (b)

designation of a fuel ERA allows for a contingency fuel reduction of 2% of the required trip fuel, which is quite significant.[6]

[6] Chapter references:

- ICAO Doc 4444 Procedures for Air Navigation Services: Air Traffic Management, 16th Edition, 2016
- ICAO Doc 9981 Procedures for Air Navigation Services: Aerodromes, 3rd Edition, 2020
- ICAO Doc 8168 Procedures for Air Navigation Services: Aircraft Operations, 6th Edition, 2018

1.6 Destination Alternate Aerodrome

An aircraft operator is required to specify at least one destination alternate aerodrome in its operational and air traffic services flight plan, to which an aircraft could divert if it becomes either impossible or inadvisable to land at the intended destination aerodrome.

The requirement to specify at least one destination alternate aerodrome can only be waived after due consideration of the following:

- The planned flight time from take-off to landing at the intended destination aerodrome does not exceed six hours.
- The meteorological reports and forecasts indicate that visual meteorological conditions will prevail during the approach and landing at the intended destination aerodrome. Furthermore, no thunderstorms, heavy precipitation or fog shall be forecasted.
- For FAA regulations, the above is to be replaced by a ceiling of 1500 ft above the applicable landing minima or at least 2000 ft above aerodrome elevation, and a visibility of at least 3 SM or 2 SM more than the required visibility by the approach procedure.
- Two or more separate runways are available and usable at the intended destination aerodrome. Separate runways may overlay or cross but only in such a way that if one runway is blocked, the other runway is still usable for approach and landing. Additionally, needs to have a separate approach procedure based on a separate navigational aid.

In some cases, aircraft operators need to specify two destination alternate aerodromes. This applies when the destination aerodrome is below the applicable planning minima, or no meteorological information is available for the destination aerodrome.

Implications of destination alternate aerodromes on fuel planning and fuel consumption:
The availability of destination alternate aerodromes usually has the greatest influence on fuel planning and fuel consumption compared to take-off alternate aerodrome, ERA, and fuel ERA. Generally, without consideration of aircraft operator decision making models, it can be stated that the required alternate fuel increases approximately linearly with the distance between the destination and destination alternate aerodrome, as shown exemplary for an Airbus A321 below. With additional requirements of major airlines which go beyond the regulatory requirements for fuel planning, this relationship changes, as will be discussed in chapter 3 Introduction to Airline Decision Making Models for Alternate Aerodrome Planning.[7]

[7] Chapter references:
- ICAO Doc 4444 Procedures for Air Navigation Services: Air Traffic Management, 16th Edition, 2016
- ICAO Doc 9981 Procedures for Air Navigation Services: Aerodromes, 3rd Edition, 2020
- ICAO Doc 8168 Procedures for Air Navigation Services: Aircraft Operations, 6th Edition, 2018
- FAA: 14 CFR § 121.621 Alternate airport for destination: Flag operations

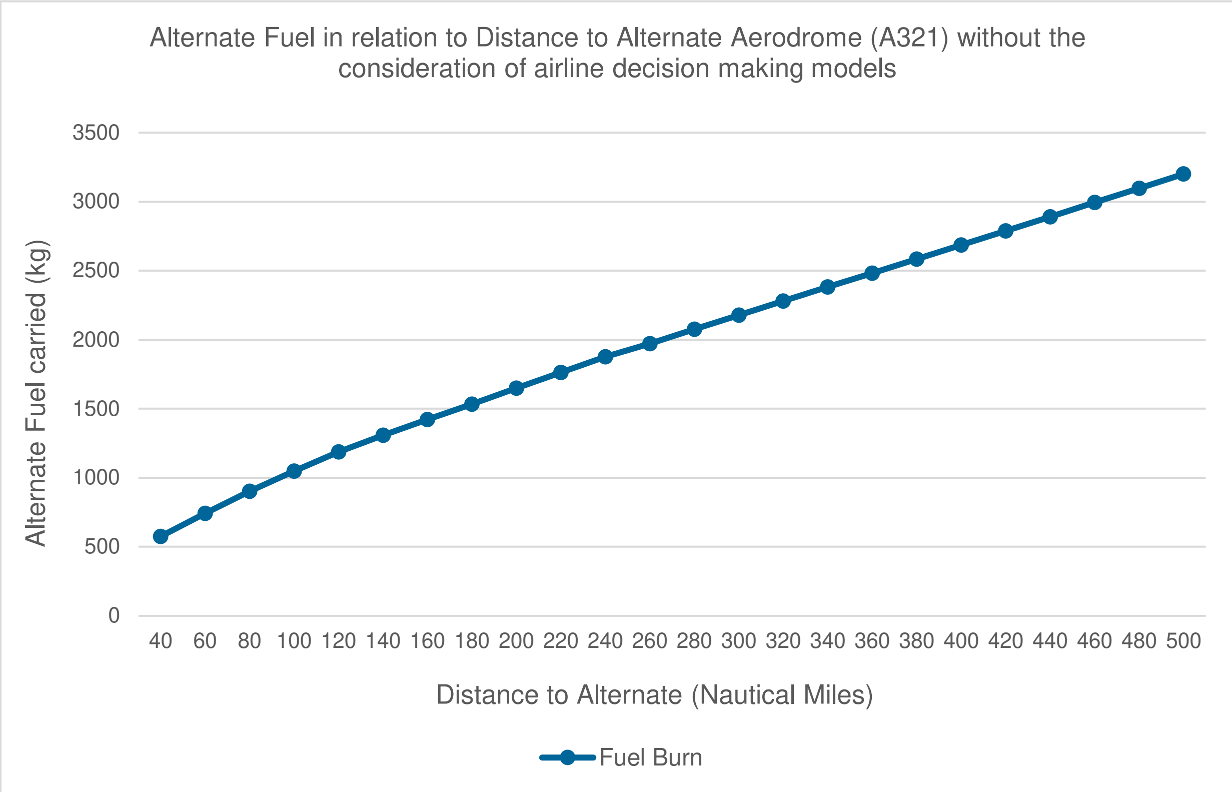
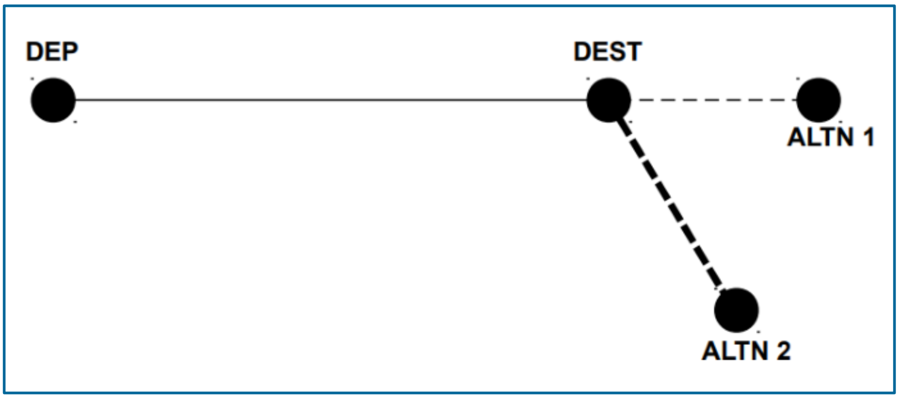


Figure 3 Alternate Fuel carried in relation to Distance to Alternate Aerodrome for Airbus A321 without the consideration of airline decision making models (indicative: do not use for real-word navigation)[8]

[8] Reference: Munich Airport International GmbH, 2024, Data: Airbus FCOM A321

1.7 Planning with Two Destination Alternate Aerodromes

An aircraft operator is required to specify two destination alternate aerodromes in case the destination aerodrome is below the applicable planning landing minima, or no meteorological information is available for the destination aerodrome.
If an aircraft operator needs to satisfy the requirement of planning with two destination alternate aerodromes, the amount of alternate fuel shall cover both destination alternate aerodromes.[9]



[10]

Figure 4 Fuel Planning with two destination alternate aerodromes

[9] Chapter references:
- ICAO Doc 4444 Procedures for Air Navigation Services: Air Traffic Management, 16th Edition, 2016
- ICAO Doc 9981 Procedures for Air Navigation Services: Aerodromes, 3rd Edition, 2020
- ICAO Doc 8168 Procedures for Air Navigation Services: Aircraft Operations, 6th Edition, 2018

[10] Reference: Munich Airport International GmbH, 2024

2 Operational Classification of Aerodromes

When an aircraft faces a diversion event, it means it cannot proceed to its intended destination due to unforeseen circumstances such as weather, technical issues, failure of ground infrastructure, or air traffic control directives. In such situations, the primary concern of the aircraft operator is to ensure the safety of passengers, crews, and the aircraft itself. This entails maintaining safety standards comparable to what would have been upheld if the flight had continued to its intended destination without any interruptions.

However, safety is not the only consideration during a diversion. Operational aspects need to be considered as well. These include factors like ground handling capabilities, passenger handling facilities, and security considerations at the alternate aerodrome.

To facilitate efficient alternate aerodrome planning, aircraft operators provide guidance on which airports to use under different scenarios. This guidance helps airline dispatchers and flight crews to make informed decisions when selecting alternate aerodromes based on various factors, which well be outlined in the following.

Aircraft operators typically categorize aerodromes into different categories, to streamline diversion planning processes and ensure that appropriate alternate aerodromes are selected based on the specific needs and circumstances of each diversion event. This helps to achieve high levels of safety while maintaining operational efficiency and passenger comfort.

A typical categorization of aerodromes by aircraft operators, usually differentiates into three categories:

Basic Aerodrome:

A basic aerodrome meets minimum requirements for diversion purposes. Basic aerodromes are aerodromes on which the aircraft can be safely operated, considering aircraft performance requirements and runway characteristics. The aerodrome needs to be available at the expected time of use and needs to be equipped with at least air traffic services, communication systems, adequate lighting, meteorological reporting, navigation aids and emergency services sufficient for the operated aircraft type.

A basic aerodrome allows an aircraft to safely land in case of a diversion. However, due to missing ground services, a departure within reasonable time might not be possible.

Planning Aerodrome:

A planning aerodrome offers a higher level of services and facilities compared to a basic aerodrome and is therefore more suitable for diversions. A planning aerodrome meets all requirements of a basic aerodrome, but additionally offers refuelling services for the operated aircraft type. A planning aerodrome allows an aircraft to land and depart again in a diversion scenario, however major handling restrictions are to be expected.

Operational Aerodrome:

An operational aerodrome offers comprehensive facilities and resources and allows a flight to be completed at this aerodrome. It often serves as a primary aerodrome for many flight routes and therefore offers extensive services. An operational aerodrome therefore meets all requirements of a planning aerodrome, and additionally provides ground handling, passenger handling, immigrations, and customs.

Conclusion:

Most airlines require any alternate aerodrome to be at least a planning aerodrome. Usually, a planning aerodrome is acceptable for flights where the meteorological forecasts indicate that a diversion is unlikely. However, if meteorological forecasts or any other observations indicate that a diversion might become likely, an operational aerodrome should be planned for.

3 Introduction to Airline Decision Making Models for Alternate Aerodrome Planning

In addition to the regulatory requirements applicable to alternate aerodrome planning and fuel planning as outlined in chapter 1.0 Introduction to Alternate Aerodrome Planning, major airline operators have usually defined further requirements for safe and efficient planning within their decision-making models. The rationale behind these models states that the alternate aerodrome specified in the operational flight plan, which mainly is a result from regulatory requirements, might not always be a good or even valid alternative action. Therefore, these models recommend the uplift of additional, so-called discretionary fuel, to cater for these circumstances and to ensure a valid alternative plan is always available. As these models vary with different aircraft operators, the description below is an indicative example of the core elements of a general simplified model.

A prerequisite of most models is, that the alternative plan needs to always be associated without any risks. Risks in this context are defined individually by each operator and usually comprise ceilings and visibilities/RVRs close to the landing minima, strong crosswinds, low visibility procedures in force, thunderstorm activity, etc. The alternative plan therefore does not necessarily need to be the destination alternate aerodrome as specified in the operational flight plan. The reasons for this are, that the risks defined by operators are more restricting than the legally required planning minima for alternate aerodromes as dictated by the competent authorities. An example for this could be a situation with forecasted strong - but however still within the certified limits of the aeroplane - crosswinds at the planned destination alternate aerodrome. This aerodrome would then still be specified as destination alternate aerodrome in the air traffic services flight plan, however flight crews would internally plan for an aerodrome without any risks, as defined by the operator decision making model, and consequently carry the fuel to reach this aerodrome in case a diversion becomes necessary.

In general, it can be differentiated between situations where there is no imminent risk at a destination aerodrome which favours a diversion, or situations associated with risks which increase the probability of a diversion to an alternate aerodrome.

Case A: No imminent risks at the destination aerodrome which favour a diversion

In this case, there is neither an operational nor weather related risk at the destination aerodrome, which means the probability for a diversion is rather low. In this case, operators usually request to have a remaining endurance of 30 minutes flying time according to the extra fuel flow at the alternative plan aerodrome.
Additionally, during the pre-flight planning, flight crews should usually ensure that the planned fuel at touchdown at the intended destination aerodrome is not less than 60 minutes flying time according to the extra fuel flow of the specific aircraft.

In other words, the sum of final reserve fuel, alternate fuel and discretionary fuel should not be below the fuel required for 60 minutes flying time.

final reserve fuel (30 minutes)
+ alternate fuel
+ discretionary fuel
>= 60 minutes

This holds major implications on the fuel planning for destination alternate aerodromes closely located to the destination aerodrome. As outlined in chapter 1.2 Introduction to Pre-Flight Fuel Requirements for Commercial Flights, the flight crew needs to ensure that the final reserve fuel is always on board. It may never be used or even planned with, except in emergency situations as deemed necessary by the commander. For this purpose, a diversion is not considered an emergency. Final reserve fuel equals to approximately 30 minutes of endurance. In case the destination alternate aerodrome is closely located to the destination, the amount of alternate fuel will be less than 30 minutes of endurance, which requires the flight crew to uplift discretionary fuel.
Considering the indicative example for the required alternate fuel for an Airbus A321 previously shown in chapter 1.6 Destination Alternate Aerodrome, the graph changes accordingly: Within the distance, which equals 30 minutes of flying time, the required amount of alternate fuel to be uplifted remains constant and continues to increase approximately linearly to the distance thereafter.

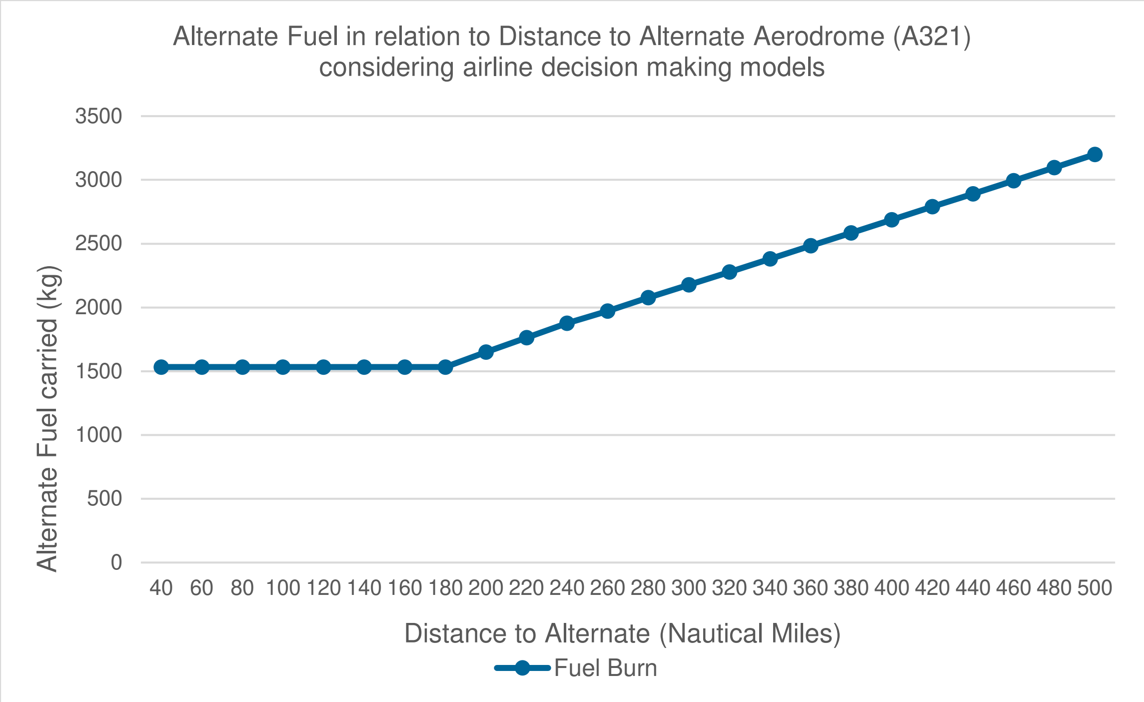


Figure 5 Alternate Fuel carried in relation to Distance to Alternate Aerodrome for Airbus A321 considering airline decision making models (indicative: do not use for real-word navigation)[11]

In summary it can be stated that from a fuel planning perspective, it does not make any difference if a destination alternate aerodrome is located within 30 minutes of flying time from the intended destination aerodrome or even closer.

[11] Reference: Munich Airport International GmbH, 2024, Data: Airbus FCOM A321

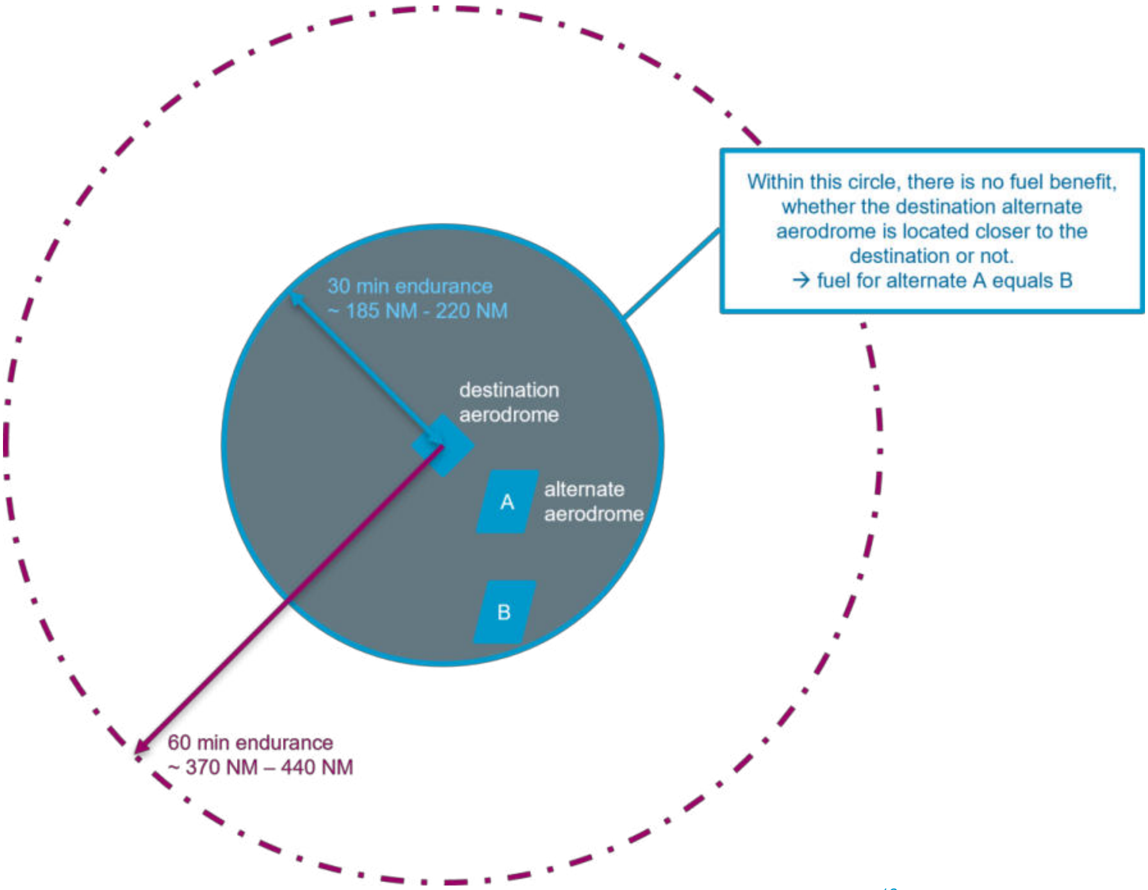


Figure 6 Circle of equal fuel for different destination alternate aerodrome locations.[12]

Case B: Imminent risks at the destination aerodrome which favour a diversion

In this case, there is an operational or weather-related risk at the destination aerodrome, which increases the probability for a diversion. The flight crew now must ensure that their alternative plan aerodrome is an aerodrome without any risks. The alternative plan aerodrome therefore does not necessarily have to coincide with the regulatory required destination alternate aerodrome, since regulatory and company requirements are different. An aerodrome which is legally plannable as destination alternate aerodrome is not always a valid alternative action. This especially applies for situations where destination and destination alternate aerodrome are closely located to each other.
In the case of risks at the destination aerodrome, operators usually require their flight crews to ensure 45 minutes of flying time at their alternative plan airport.

[12] Reference: Munich Airport International GmbH, 2024

4 Requirements and Best Practices for Alternate Planning

4.1 Preface

Aerodromes are required to comply with rigorous and all-encompassing standards that have been developed by several state-level organizations, such as the ICAO, as well as industry stakeholders, such as ACI, or the International Air Transport Association (IATA). Each of these components serves as the basis for the legal framework of any domestic legal system.

Article 15 of the Convention on International Civil Aviation stipulates that all aerodromes that are open to the public and are under the authority of a contracting state are required to provide uniform conditions for aircraft belonging to all other contracting states.

In accordance with Articles 28 and 37 each state is obliged to provide airports and other air navigation facilities and services in its territory in accordance with the Standards and Recommended Practices (SARPs) developed by ICAO. Volume I of Annex 14 to the Convention contains SARPs on the subject of aerodrome design and operation. Responsibility for ensuring safety, regularity, and efficiency of aircraft operations at aerodromes under their respective jurisdiction rests with individual states.

The specifications also outlined in ICAO Doc 9673, which pertain to the Air Navigation Plans: Air Basic Operational Requirements and Planning Criteria (BORPC), highlight the importance of determining the alternate aerodrome and that the regular aerodromes and their alternates should be determined based on the needs identified by users.

When examining the requirements for alternate aerodromes, the guiding principle is that the requirements for alternate aerodromes are satisfied by regular aerodromes used for international aircraft operations. Hence, it is essential for airport operators who plan to position their aerodrome as an alternate aerodrome, to comply with all established requirements needed to obtain an aerodrome certification.

4.2 Minimum Requirements

It is common practice to categorize alternate aerodromes based on different criteria, to standardize and facilitate efficient alternate aerodrome planning. As criteria might slightly differ from operator to operator, the main determinant for the three different categories results from the availability of different aerodrome facilities and services. A typical categorization of aerodromes by aircraft operators, usually differentiates into three categories: basic aerodrome, planning aerodrome, and operational aerodrome, as shown below:

	Basic Aerodrome	Planning Aerodrome	Operational Aerodrome
Basic necessary equipment and facility e.g. Aerodrome Availability, ATC, Emergency service	✓	✓	✓
Superior aircraft service and facilities e.g. Aircraft refueling service	✗	✓	✓
Wide range of facilities and services for aircraft and PAX e.g. Passengers Handling, Hotel and transportation, Ground handling	✗	✗	✓

Figure 7 Aerodrome Categorization according to industry best practices[13]

[13] Reference: Munich Airport International GmbH, 2024

4.3 Basic Aerodrome:

In terms of aircraft diversion, a basic aerodrome is capable of meeting the essential requirements. The phrase "basic aerodrome" pertains to aerodromes that provide the necessary equipment and facilities to effectively and safely operate aircraft, while also considering the performance specifications of the aircraft and their physical characteristics.

In order to be deemed relevant, the following criteria must be met:

Criteria	Description
Aerodrome Availability	Hours of operation or ability to respond to a diversion.
Performance requirements	Performance requirements for the expected landing weight (e.g. runway length, width).
Ground operational services	Air traffic service, lighting, communications, weather reporting.
Runway strength	Allowance for ICAO and state overload guidance[14] and the aerodrome reference code(s) selected for runway and taxiway planning purposes.
Navigation aid and approach procedure	At least one approach procedure based on a ground-based navigation aid.
Emergency services	The adequacy of the emergency response, rescue and firefighting services available at the aerodrome

Note:
At alternate aerodromes, the physical characteristics should be determined in accordance with the landing requirements of the diverted critical aircraft and the take-off requirements for the aircraft for a flight to the aerodrome of intended destination. To ensure safe taxiing operations, a specified taxiway route should be determined for the diverted critical aircraft.

[14] ICAO Doc 9157 Aerodrome Design Manual Part 3 - Pavements, 4th Edition, 2020

4.4 Planning Aerodrome

In comparison to a basic aerodrome, a planning aerodrome provides a superior level of service and amenities, rendering it more appropriate for aircraft diversion purposes. A planning aerodrome meets all the requirements of a basic aerodrome, while additionally offering the most essential ground handling that requires aircraft fuelling to the particular type of aircraft being handled.

Additional to all requirements for a basic aerodrome, an operational aerodrome should be equipped with aircraft refuelling services and facilities for the operated type of aircraft.

Criteria	Potential Service Items	Description and considerations
Aircraft refueling service	▪ 100LL ▪ Jet-A/Jet-A1 ▪ Lubricants	▪ Provide a range of services for the refuelling of aircraft Considerations: ▪ Self-serve or full-serve ▪ Sufficient demand for different fuel types to sell within shelf life ▪ Fuel supplier as resource if establishing new system ▪ Number and size of fuel tanks ▪ Number and size of fuel trucks.

4.5 Operational Aerodrome

An operational airport provides a wide range of facilities and resources, enabling the completion of flights at this aerodrome. In some instances, it serves as a major airport for several flight routes, hence providing a wide range of services. An operational airport fulfills all the necessary criteria for a planning aerodrome, while also offering ground handling, passenger handling, immigrations, and customs services, etc.

Criteria	Potential Service Items	Description and considerations
Ground handling services	▪ Convenient aircraft parking with pushback or self-manoeuvring stands ▪ Tug service ▪ Load/unload assistance including ULD high loader and belt loader ▪ Escorted apron auto access ▪ Ground power unit ▪ Air starter unit ▪ Lavatory service ▪ Oxygen/nitrogen service ▪ Crew cars ▪ Cargo handling services ▪ Engine pre-heat equipment ▪ Catering service ▪ Water service ▪ Aircraft cleaning service ▪ De-icing service (if required at location)[15] ▪ Cargo handling	Essential ground handling services consist of aircraft fuelling, line service, aircraft parking and storage, and maintenance. It is necessary to take the following factors into consideration. ▪ Size of aircraft using aerodrome ▪ Demand for 24-hour service ▪ Provisions for after hour on-call services ▪ Security for parked aircraft ▪ Compliance with regulations for chemical use
Overnight/Long-term parking space	▪ Long-term space (Hangar) ▪ Overnight hangar space ▪ Tie-downs	It is necessary to take these factors into consideration. ▪ Size of aircraft that need to be accommodated ▪ In-out service ▪ Space available for future development
Major aircraft maintenance repairs	MRO services available for the following: ▪ Structure ▪ Engine	It is necessary to take these factors into consideration.

[15] Aircraft de-icing services might even be required in hot and humid regions, as ice accumulation can build up on cold soaked wings of aircraft descending in humid air.

and overhaul (MRO) services available	▪ Avionics ▪ Cabin	▪ Employee training/certification (A&P mechanic) ▪ Type of aircraft to be served ▪ Competition from surrounding airports
Passenger Handling Services	▪ Contracted passenger handling company ▪ Immigration and border control ▪ Customs ▪ Government agencies ▪ PRM Handling ▪ Baggage handling ▪ Security control facilities ▪ Medical facilities	It is necessary to take these factors into consideration. ▪ Passenger handling company ▪ Hours of operation or ability to respond to a diversion ▪ Local hospital and pharmacy to provide delivery of vital medication ▪ International aircraft diversions during off-hours operations of border control
Hotel and Transportation	▪ Overnight Accommodations ▪ Bus shuttle service ▪ Ground transportation ▪ Support for special-needs passengers	The provision of local hotel rooms and/or ground transportation is necessary to accommodate passengers who may require extended delay accommodations. It is necessary to take these factors into consideration. ▪ Transportation company ▪ Hotel room availability in local area

4.6 Conclusion

An alternate aerodrome is a designated aerodrome where an aircraft may perform an appropriate landing in the event it is unable or inadvisable to continue and land at its intended destination. This occurrence is commonly witnessed when the planned destination is affected by adverse weather conditions and several other factors.

Airline operators have the ability to select a diversion aerodrome from a range of options based on two primary criteria. Initially, the diverted aircraft must have enough fuel to travel to the alternate airport. Additionally, the characteristics of the diversion airport, such as the length of the runways, the capacity of the runways, and the facilities of the apron, must be appropriate for accommodating the affected flights.
In addition to these two primary requirements, there are various additional factors to consider while seeking a diversion aerodrome, including the presence of a maintenance and service facility for handling operations.

It is also essential to note that the alternate aerodrome must be certified in accordance with the technical guidance material for aerodrome licensing and certification published by the South African Civil Aviation Authority and the above-mentioned international regulations. Certification is necessary to demonstrate and continuously monitor compliance with a multitude of complex regulations and requirements in order to establish and maintain a high and uniform level of safety in aerodrome operations.[16]

Additionally, it is worth mentioning that an international license is not a prerequisite for an airport to fulfill the criteria for being chosen as an alternate (basic/planning/operational). One important condition for passengers is that they should not disembark from the aircraft, unless they have made prior arrangements with the authorities. This requirement ensures that passengers remain on board and follow the necessary protocols.

Chapter references:
- ICAO SARPS Annex 14 Aerodromes Volume I: Aerodromes Design and Operations, 9th Edition, 2022
- ICAO SARPS Annex 15 Aeronautical Information Services, 16th Edition, 2018
- ICAO Doc 9981 Procedures for Air Navigation Services: Aerodromes, 3rd Edition, 2020
- ICAO Doc 8168 Procedures for Air Navigation Services: Aircraft Operations, 6th Edition, 2018
- ICAO Doc 9774 Manual on Certification of Aerodromes, 1st Edition, 2001

4.7 Exemplary Airline Checklist for Alternate Planning

The subsequent checklist form provides an example of an international airline's checklist for the selection of alternate aerodromes. The information to be considered consists of a wide range of factors, including aerodrome contact details, availability of operational equipment for different types of aircraft, disembarkation procedures for diverted flights, aerodrome authority information, hotel, and transportation arrangements, as well as necessary ground handling contact details.

1.	Alternate Airport Name and Contact					
Name of Airport	Click here to enter Name of Airport		IATA	IATA Code	ICAO	ICAO Code
Airport Authority	Click here to enter Name of Airport Authority		Phone	Click here to enter phone number		
Type of Airport	International	☐	Regional	☐	Military	☐
ACARS available?	yes	☐	no	☐		

2.	Airport Information & Operational Equipment														
Aircraft Type / Available infrastr. & EQT	Narrowbody				Widebody										Comment
	E190/E195	CRJ900	A220-100/300	A319/320/321	A333/A343	A346	A359	A388	B744	B748	B767	B777	B777X	B787	
Self-Maneuvering Stands avail. !	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
Push Back avail. !	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
Tow Bar avail. !	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
ULD-High Loader avail.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
Belt Loader avail.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
GPU avail.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
ASU avail.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
De-Icing avail.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
Lavatory Service avail.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
Water Service avail.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Click here to enter a comment
Additional Parking Info	Click here to enter text														
Additional Information	Click here to enter text														

3.	Disembarking Information					
Mode of Disembarkation !	Bridge	☐	Stairs - Walk	☐	Stairs - Bus	☐
Organization & Coordination Procedure	Click here to enter text					
Procedures for deplaning a diverted flight	Click here to enter text					

Passenger Transportation Provider	Name	Click here to enter text				
	Phone	Click here to enter text				
Coordinated by	SM	☐	Airport Auth.	☐	Other	Click here to enter text

4. Additional Airport Authorities

Local Immigration / Customs & Border Protection (CBP)	available	Yes	☐	Duty Hours	Click here to enter text
		No	☐	Max Hdlg. Capacity (pax/h)	Click here to enter text
Information lead time required by Immigration	Click here to enter text				
Resources Immigration will provide	Click here to enter text				
Special Immig. procedures	Click here to enter text				
Name	Click here to enter text	E-Mail	Click here to enter text	Phone	Click here to enter text

Transportation Security Administration (TSA)	available	Yes	☐	Duty Hours		Click here to enter text
		No	☐	Max Hdlg. Capacity (pax/h)		Click here to enter text
Resources TSA will provide	Click here to enter text					
Special TSA procedures	Click here to enter text					
Name	Click here to enter text	E-Mail	Click here to enter text		Phone	Click here to enter text
Local Security Company	available	Yes	☐	Duty Hours		Click here to enter text
		No	☐			
Resources provided	Click here to enter text					
Special procedures	Click here to enter text					
Name	Click here to enter text	E-Mail	Click here to enter text		Phone	Click here to enter text
Coordinated by	SM	☐	Apt. Authority	☐	Other	Click here to enter text

5. Airport Handling Contacts !

Passenger Handling	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
PRM Handling	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
Ramp Handling	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
Cleaning Company	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
Toilet Service Comp.	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
Water Service Comp.	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
	IDQP audit available		Yes	☐	No	☐	
Cargo Handling	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
Fuel Provider	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
	IFQP audit available		Yes	☐	No	☐	
Fuel-Into-Plane Service Company	Name	Click here to enter text			Phone	Click here to enter text	
	E-Mail	Click here to enter text			Duty hours	Click here to enter text	
	Fuelling with passengers on board possible		Yes	☐	No	☐	
	If yes, fire department conditions		Informed	☐	Standby	☐	On position ☐
De-Icing Company	available	Yes ☐	Name	Click here to enter text			
		No ☐	Phone	Click here to enter text			
	Duty Hours	Click here to enter text	E-Mail	Click here to enter text			
	Avail. fluid type	Type I ☐	Type II / IV	☐	Other	Click here to enter text	
	Fluid brands	Click here to enter text	Click here to enter text		Click here to enter text		
	DAQCP audit available		Yes	☐	No	☐	
	Name	Click here to enter text			Phone	Click here to enter text	

Catering Company	E-Mail	Click here to enter text				Duty hours LT		Click here to enter text		
	Special Catering Procedure	Click here to enter text								
ATC Contact Numbers	Tower, Phone	Click here to enter text								
	Apron, Phone	Click here to enter text				Duty hours		Click here to enter text		
Technical Provider	Name	Click here to enter text				Phone		Click here to enter text		
	E-Mail	Click here to enter text				Duty hours LT		Click here to enter text		
	available licenses	E190/5	☐	A320	☐	A340	☐	B744	☐	B777 ☐
		CRJ9	☐	A321	☐	A350	☐	B748	☐	B777X ☐
		A319	☐	A330	☐	A380	☐	B767	☐	B787 ☐
coordinated by	SM	☐	Apt. Authority	☐	Other	Click here to enter text				

6. Hotel & Transportation

Hotel	Name	Click here to enter text	Phone	Click here to enter text
	E-Mail	Click here to enter text		
Comments (if any)	Click here to enter text			
Transportation Company	Name	Click here to enter text	Phone	Click here to enter text
	E-Mail	Click here to enter text		
Comments (if any)	Click here to enter text			
coordinated by	SM ☐	Airport Authority ☐	Other	Click here to enter text

7. Data Administration

Information collected by	Name	Click here to enter text		
	E-Mail	Click here to enter text		
	Collection date	Click here to enter text	Data upload date*	Click here to enter text
TSA*	Name of recipient	Click here to enter text	Date sent	Click here to enter text
CBP*	Name of recipient	Click here to enter text	Date sent	Click here to enter text
Airport Authority*	Name of recipient	Click here to enter text	Date sent	Click here to enter text

8. Additional Comments/Recommendations to Flight Ops by responsible Station Manager

Comments/ Recommendations	Click here to enter text

! obligatory information
** USA & Canada only*

Intentionally left blank

5 South African Alternate Airport Evaluation

5.1 Introduction

The following work package evaluates the suitability of the six proposed South African airports by the client as destination alternates for a range of aircraft types and variants that are operating in the South African region. Evaluation criteria are used to highlight the suitability of each aircraft type at each of the six airports. These criteria include an assessment of: aircraft performance, apron/taxiway strength, operating hours, ground handling services, fuel services, maintenance services, passenger services, fire fighting and rescue services, runway approach lighting, instrument landing system, air traffic control services, space on aprons, and meteorological facilities.

The airports that are evaluated in this work package include:

- Bloemfontein Airport (FABL)
- Durban Airport (FALE)
- George Airport (FAGG)
- Johannesburg OR Tambo Airport (FAOR)
- Port Elizabeth Airport (FAPE)
- Cape Winelands Airport (FAWN) as benchmark

Note: Military airports have not been considered in this study, as they may not be nominated as alternate aerodrome in South Africa.[17]

The evaluated aircraft types in this work package include:

- Airbus A380
- Boeing B747-400
- Boeing B747-8
- Boeing B787-10
- Boeing B787-9
- Boeing B787-8
- Airbus A350-1000
- Airbus A350-900
- Boeing B777-300
- Boeing B777-200
- Airbus A340-300
- Airbus A321 NEO
- Boeing B737 Max 8

To evaluate the suitability of the six South African airports as destination alternate aerodrome for CPT, different categories are assessed:

[17] According to AIP South Africa, 15th July 2023, AD 0.6-1, page 199

5.2 Operating Hours

Airport operating hours are one performance metric that can be used to help determine the suitability of the proposed South African airports as destination alternate for the existing Cape Town International Airport. To serve as a destination alternate aerodrome, the aerodrome needs to be operational at the expected time of use. This includes airport operating hours and ATC operating hours at the aerodrome.

The operating hours for each airport are benchmarked to CPT´s hours of operation and flight schedule to assess whether it can serve as a suitable destination alternate. Flight distances from CPT to the proposed alternate airports are also factored into the assessment.

Cape Town International Airport (CPT)		
Operating Hours		24 Hours
Flight Schedule (First and Last Arrivals)	AM Schedule – First Arrival Flights B737-8 (Narrowbody): 8:15am A350-900 (Widebody): 9:25am (summer schedule) 6:30 am (winter schedule)	PM Schedule – Last Arrival Flights B777-200 (Widebody): 21:25pm A320-200 (Narrowbody): 22:40pm

Operating Hours

	Bloemfontein Airport	Cape Winelands Airport	Durban Airport	George Airport	OR Tambo Airport	Port Elizabeth Airport
Airport Operating Hours	MON-FRI 04:00am-18:00pm SAT: 07:30am-14:00pm SUN: 07:30am-18:00pm	TBD – Will be similar or in line with CPT	24 hours	Mon-Thr: 04:30am-17:00pm; Fri: 04:30am-18:00pm Sat: 06:30am-13:00pm; Sun: 06:30am-1730pm	24 hours	Mon-Sun: 03:00am - 19:30pm
ATC Services Operating Hours	MON-FRI: 0445-1715 SAT: 0700-1400 SUN: 0730-1715	TBD	24 Hours	MON-THU: 0430-1700; FRI: 0430-1800 SAT: 0630-1300; SUN: 0630-1730.	24 Hours	MON - FRI: 0430–1800, SAT: 0545 -1730, SUN: 0545 - 1800
Flight Time from CPT to the Alternate Airport	1 hour 20 minutes	10 minutes	1 hour 45 minutes	40 minutes	1 hour 40 minutes	1 hour
Operating Hours Compatibility?	First Arrivals: Yes Final Arrivals: No	First Arrivals: Yes Final Arrivals: Yes	First Arrivals: Yes Final Arrivals: Yes	First Arrivals: Yes Final Arrivals: No	First Arrivals: Yes Final Arrivals: Yes	First Arrivals: Yes Final Arrivals: No

As illustrated in the table above, all the proposed South African airports are compatible to serve as an alternate airport destination for first arrivals into Cape Town International Airport. On the other hand, only two of the six proposed airports would be able to serve as alternate airports for final arrivals diverting from CPT.

5.3 Aircraft Performance

5.3.1 Take-Off Performance

The following table provides a list of the six proposed airports and a description of some of their aircraft performance related characteristics. These include the take-off run available (TORA), runway width, and the elevation of each airport, which is used to calculate the pressure altitude, which is needed for the performance analysis. This information will be used to assess whether each airport has the required size and dimensions to accommodate the aircraft proposed by the client. For this assessment the performance data of the different aircraft have been reviewed and the maximum performance limited take-off weight (PTOW) has been calculated based on the aircraft manufacturer's handbooks. If the airport allows to take-off with the maximum take-off weight (MTOW), the table below states MTOW. If the airport imposes performance restrictions for the take-off, the table states the PTOW per aircraft.

Note: In a diversion event, an airport does not necessarily need to accommodate an aircraft up to MTOW. If the diverted aircraft continues to CPT after ground servicing at the diversion airport, the aircraft will be significantly below MTOW, due to the low block fuel needed for the flight back to CPT. For this case, MAI recommends carrying out further analysis, to analyse the impact on the suitability of the evaluated airports below. However, if the aircraft flies back to its home base after the turnaround at the diversion airport, MTOW should be achieved.

	Bloemfontein Airport	Cape Winelands	Durban Airport	George Airport	OR Tambo Airport	Port Elizabeth Airport
TORA & width	2,563m x 46m	3,500m x 45m	3,700m x 60m	2,120m x 45	4,421m x 60m	2160 x 46m
Elevation	4457 feet	399 feet	304 feet	648 feet	5558 feet	229 feet
Performance Limited Takeoff Weight (PTOW) for Selected Aircraft						
A380-800 MTOW (560t)	470 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	480 tonnes (PTOW)	550 tonnes (PTOW)	485 tonnes (PTOW)
B747-8 MTOW (442t)	355 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	364 tonnes (PTOW)	MTOW Achieved	367 tonnes (PTOW)
B747-400 MTOW (396t)	315 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	330 tonnes (PTOW)	MTOW Achieved	334 tonnes (PTOW)
B787-10 MTOW (254t)	212 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	215 tonnes (PTOW)	235 tonnes (PTOW)[18]	218 tonnes (PTOW)
A350-1000 MTOW (316t)	250 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	260 tonnes (PTOW)	295 tonnes (PTOW)	265 tonnes (PTOW)
B777-300 MTOW (300t)	242 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	237 tonnes (PTOW)	279 tonnes (PTOW)[18]	240 tonnes (PTOW)

[18] Limited by Tire Speed Limit and/or Brake Energy Limit due to high elevation, not by physical runway length.

A340-300 MTOW (267t)	215 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	227 tonnes (PTOW)	255 tonnes (PTOW)[19]	230 tonnes (PTOW)
A350-900 MTOW (280t)	245 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	245 tonnes (PTOW)	265 tonnes (PTOW)	250 tonnes (PTOW)
B777-200 MTOW (247t)	231 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	243 tonnes (PTOW)	MTOW Achieved	245 tonnes (PTOW)
B787-9 MTOW (254t)	210 tonnes (PTOW)	MTOW Achieved	MTOW achieved	204 tonnes (PTOW)	233 tonnes (PTOW)[19]	205 tonnes (PTOW)
B787-8 MTOW (227t)	179 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	193 tonnes (PTOW)	208 tonnes (PTOW)	195 tonnes (PTOW)
A321neo MTOW (93t)	86 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	MTOW Achieved	MTOW Achieved	MTOW Achieved
737 Max 8 MTOW (79t)	73 tonnes (PTOW)	MTOW Achieved	MTOW Achieved	MTOW Achieved	76 tonnes (PTOW)[19]	MTOW Achieved

All data based on manufacturer data published in Airplane Characteristics for Airport Planning manuals considering standard weight variants. Performance calculated for standard day (ISA) + 15 degrees Celsius, dry runway, on A/C. As weight variants might differ between airlines, small deviations from the above results might be possible due to other aircraft configurations. For a more detailed analysis, airline specific data should be acquired and the above analysis refined accordingly.

[19] Limited by Tire Speed Limit and/or Brake Energy Limit due to high elevation, not by physical runway length.

5.3.2 Landing Performance

If the PTOW for an airport is greater than the maximum landing weight (MLAW), this means that the aircraft can land with MLAW at this airport and no further performance calculation is required. If the PTOW is smaller than the MLAW, a performance calculation is required to assess the landing performance of the aircraft at the specific aerodrome.

Aircraft Type	Maximum Landing Weight (MLAW)	MLAW for secelected airports
A380-800 MTOW (560t)	386 tonnes	MLAW Achieved at all airports
B747-8 MTOW (442t)	312 tonnes	MLAW Achieved at all airports
B747-400 MTOW (396t)	260 tonnes	MLAW Achieved at all airports
B787-10 MTOW (254t)	202 tonnes	MLAW Achieved at all airports
A350-1000 MTOW (316t)	236 tonnes	MLAW Achieved at all airports
B777-300 MTOW (300t)	237 tonnes	MLAW Achieved at all airports
A340-300 MTOW (267t)	190 tonnes	MLAW Achieved at all airports
A350-900 MTOW (280t)	207 tonnes	MLAW Achieved at all airports
B777-200 MTOW (247t)	202 tonnes	MLAW Achieved at all airports
B787-9 MTOW (254t)	193 tonnes	MLAW Achieved at all airports
B787-8	172 tonnes	MLAW Achieved at all airports

MTOW (227t)		
A321neo MTOW (93t)	77,8 tonnes	MLAW Achieved at all airports
737 Max 8 MTOW (79t)	68,2 tonnes	MLAW Achieved at all airports

All data based on manufacturer data published in Airplane Characteristics for Airport Planning manuals considering standard weight variants. Performance calculated for standard day (ISA) + 15 degrees Celsius, dry runway, on A/C. As weight variants might differ between airlines, small deviations from the above results might be possible due to other aircraft configurations. For a more detailed analysis, airline specific data should be acquired and the above analysis refined accordingly.

5.4 Apron and Taxiway Strength

The following table provides a list of the six proposed airports and their apron and taxiway strength characteristics. This information will be used to assess whether each of the different aircraft types will be able to use the apron and taxiway infrastructure. If the Aircraft Classification Number (ACN) is lower than the Pavement Classification Number (PCN) at the selected airports, this suggests that the aircraft can operate without restrictions on the pavement, provided that its tire pressure does not exceed the PCN limitation. If the ACN exceeds the PCN, some restrictions (for example on weight of frequency of operation) may apply depending on the national or local regulations for overload operations. Except for massive overloading, pavements in their structural behaviour are not subject to particular limiting load above which they suddenly or catastrophically fail. As a result, minor or medium overload operations may be allowed by the airport authority depending on the corresponding loss in pavement life expectancy. The ACN numbers are derived from the aircraft´s maximum taxi weight.

To evaluate the apron and taxiway strength characteristics, the proposed aircraft have been clustered into four categories as agreed in the proposal. The rationale is, that if the most demand aircraft type of a cluster can be accommodated, all other aircraft types in this cluster can be accommodated as well. The aircraft types have been clustered as follows:

Aircraft proposed by client	Wingspan (m)	Length (m)	MTOW (t)	Critical
A380-800	79,75	72,57	560	A380-800
B747-400	64,92	69,85	396	
B747-8	68,40	75,23	442	
B787-10	60,12	68,30	254	A350-1000
A350-1000	64,75	73,79	316	
B777-300	60,93	73,86	300	
A340-300	60,30	63,69	267	A350-900
A350-900	64,75	66,80	280	
B787-9	60,12	62,81	254	
B777-200	60,93	63,73	247	

B787-8	60,12	56,72	227	
A321neo	35,80	44,51	93	A321neo
B737 Max 8	35,92	43,79	79	

	Bloemfontein Airport	Cape Winelands	Durban Airport	George Airport	OR Tambo Airport	Port Elizabeth Airport
Apron Characteristics	PCN: 40/R/A/X/U Surface: Concrete Strength: High	Assumption: CWA prepares surfaces to handle all expected (diversion) traffic from CPT	PCN: 83/R/C/W/T Surface: Asphalt Strength: Low	PCN: 47/R/B/X/U Surface: Concrete Strength: Medium	PCN: 66/R/A/W/U Surface: Concrete Strength: High	PCN: 44/R/A/X/U Surface: Concrete Panels Strength: High
ACN at Maximum Taxi Weight						
A380-800 MTOW (560t)	ACN: 53	ACN: 53	ACN: 76	ACN: 61	ACN: 53	ACN: 53
A350-1000 MTOW (316t)	ACN: 58	ACN: 58	ACN: 94	ACN: 74	ACN: 58	ACN: 58
A350-900 MTOW (280t)	ACN: 66	ACN: 66	ACN: 86	ACN: 74	ACN: 66	ACN: 66
A321neo MTOW (93t)	ACN: 60	ACN: 60	ACN: 65	ACN: 63	ACN: 60	ACN: 60
737 Max 8 MTOW (79t)	ACN: 52	ACN: 52	ACN: 57	ACN: 55	ACN: 52	ACN: 52

Taxiway Characteristics	PCN: 44/F/A/X/U Width: 23m Surface: ASPH Strength: High	Assumption: CWA prepares surfaces to handle all expected (diversion) traffic from CPT	PCN: 85/F/C/X/T Width: 25m Surface: ASPH Strength: Low	PCN: 49/F/B/Y/U Width: 23m Surface: ASPH Strength: Medium	PCN: 71/F/A/W/U Width: 30.5m Surface: ASPH Strength: High	PCN: 36/F/B/X/U Width: 22.5m Surface: ASPH Strength: Medium
A380-800 MTOW (560t)	ACN: 58	ACN: 58	ACN: 75	ACN: 64	ACN: 58	ACN: 64
A350-1000 MTOW (316t)	ACN: 56	ACN: 56	ACN: 77	ACN: 62	ACN: 56	ACN: 62
A350-900 MTOW (280t)	ACN: 68	ACN: 69	ACN: 83	ACN: 73	ACN: 69	ACN: 73
A321neo MTOW (93t)	ACN: 52	ACN: 52	ACN: 61	ACN: 55	ACN: 52	ACN: 55
737 Max 8 MTOW (79t)	ACN: 45	ACN: 45	ACN: 53	ACN: 48	ACN: 45	ACN: 48

All data based on manufacturer data published in Airplane Characteristics for Airport Planning manuals considering standard weight variants. As weight variants might differ between airlines, small deviations from the above results might be possible due to other aircraft configurations. For a more detailed analysis, airline specific data should be acquired and the above analysis refined accordingly.

5.5 Rescue and Fire Fighting Services

The aircraft categories for rescue and fire fighting services (RFFS) are listed in the following table. The categories have been determined by ICAO in Annex 14 of their Aerodrome Design and Operations Manual and are based on length and aircraft maximum fuselage width. In accordance with chapter 5.4 Apron and Taxiway Strength, the defined aircraft clusters are used for this analysis as well.

Aircraft	Aircraft Length (m)	ICAO RFFS category	FAA RFFS category
A380-800	72,57	10	E
A350-1000	73,79	9	E
A350-900	66,80	9	E
A321neo	44,51	7	C
B737 Max 8	43,79	7	C

Bloemfontein Airport	Cape Winelands	Durban Airport	George Airport	OR Tambo Airport	Port Elizabeth
ICAO and SACAA Category 7	Assumption: CWA provides RFFS to handle all expected (diverted) traffic	ICAO and SACAA Category 9	ICAO and SACAA Category 7	ICAO and SACAA Category 9[20]	ICAO and SACAA Category 7
A321neo compatible and lower	A380 compatible and lower	A350-1000 compatible and lower	A321neo compatible and lower	A350-1000 compatible and lower	A321neo compatible and lower

[20] According to AIP South Africa. However, OR Tambo currently operates A380-800 aircraft. This might be in accordance with a separate agreement to provide ICAO RFFS Cat 10 during A380-800 hours of operations which is not noted in the AIP.

5.6 Additional Airport Criteria

The table below evaluates additional criteria to assess the suitability of the airports as alternate aerodromes.

Criteria	Bloemfontein Airport	Cape Winelands	Durban Airport	George Airport	OR Tambo Airport	Port Elizabeth
Ground Handling Services	Available - Menzies Aviation	Will be made available	Available	Available - Bidair Services, Menzies, Aviation, Swissport[21]	Menzies Aviation and Swissport[19]	Menzies Aviation and Swissport[19]
Fuel Services	AVGAS and JET A1	Will be made available	AVGAS and JET A1	AVGAS 100 and JET A1	JET A1	AVGAS and JET A1
Maintenance Services	Not Available	Will be made available	Limited/Not Available	Available	Available	Not Available
Passenger Services	Commercial Services Airport	Will be made available	Commercial Services Airport	Commercial Services Airport	Commercial Services Airport	Commercial Services Airport
APPR/RWY Lighting	Not Available	FALS Cat 1 recommended	PALS Cat 2	PALS Cat 2	PALS Cat 2	PALS Cat 2
Precision Approach available	RNAV, VOR	ILS Cat 1 recommended	ILS Cat 2, VOR	ILS Cat 2, RNAV, VOR	ILS Cat 2, RNAV, VOR	ILS Cat 2, RNAV, VOR
Space on Aprons	Not Available	Will be made available	Limited/Not Available	Available	Available	Limited

[21] As of our knowledge, Swissport does not operate as Ground Handling Provider for South African airports anymore. However, as they are still noted in the AIP they are shown for consistency.

Meteorological Services	METAR available	METAR recommended	METAR available	METAR not available	METAR available	METAR available
	TREND available	TREND recommended	TREND available	TREND not available	TREND available	METAR available
	TAF not available	TAF recommended	TAF available	TAF not available	TAF available	TAF available

5.7 Conclusion

	Bloemfontein Airport	Cape Winelands	Durban Airport	George Airport	OR Tambo Airport	Port Elizabeth Airport
Operating Hours Compatibility	First Arrivals: Yes Final Arrivals: No	First Arrivals: Yes Final Arrivals: Yes	First Arrivals: Yes Final Arrivals: Yes	First Arrivals: Yes Final Arrivals: No	First Arrivals: Yes Final Arrivals: Yes	First Arrivals: Yes Final Arrivals: No
Take-Off Performance	Limited	All aircraft up to MTOW	All aircraft up to MTOW	Limited	Limited	Limited
Landing Performance	All aircraft up to MLAW	All aircraft up to MLAW	All aircraft up to MLAW	All aircraft up to MLAW	All aircraft up to MLAW	All aircraft up to MLAW
Apron/Taxiway Strength at Max. Taxi Weight	All aircraft clusters weight restricted	All aircraft	Except A350-900 & A350-1000	Only 737 Max 8, all others weight restricted	All aircraft	All aircraft clusters weight restricted
ICAO RFFS	A321neo compatible and lower	A380 compatible and lower	A350-1000 compatible and lower	A321neo compatible and lower	A350-1000 compatible and lower[22]	A321neo compatible and lower
Additional Airport Criteria	no maintenance, no APPR/RWY lighting, no precision APPR, no space on aprons, limited MET services	All additional airport criteria met	All additional airport criteria met, except: maintenance, space on aprons	All additional airport criteria met, except: MET services	All additional airport criteria met	All additional airport criteria met, except: maintenance, limited space on aprons

[22] According to AIP South Africa. However, OR Tambo currently operates A380-800 aircraft. This might be in accordance with a separate agreement to provide ICAO RFFS Cat 10 during A380-800 hours of operations which is not noted in the AIP.

Conclusion:

After using the evaluation criteria to assess the six proposed South African airports, it can be determined that only three of the six proposed airports provide a suitable destination alternate for Cape Town International Airport. As illustrated from the tables above, Cape Winelands, Durban and OR Tambo Airports are able to sufficiently handle the vast majority of aircraft types from Cape Town International. All three airports met the criteria for 'Airport Operating Hours', 'Landing Performance' for all aircraft, suitable 'Take-Off Performance' for all specified aircraft at MTOW (with limitations for OR Tambo Airport because of its high elevation), and each of the requirements in the 'Additional Airport Criteria' table.

There were two exceptions however, where one or more of the three airports did not successfully meet the evaluation criteria requirements. These included 'Apron/Taxiway Strength' and 'Firefighting and Rescue Services'. It should be noted that Durban Airport cannot sustain the Maximum Taxi Weight of an A350-900/1000 type aircraft. While the -900 variant utilises Durban Airport for flight operations, it does not operate at Maximum Taxi Weight in order to meet the pavement classification number requirements for the airport. On the other hand, both Durban and OR Tambo operate as ICAO RFFS Cat 9 airports, meaning they cannot legally meet the firefighting requirements for A380-800 aircraft. It should be noted however, that OR Tambo operates A380-800 aircraft at its airport and is able to meet Category 10 fire fighting requirements through additional agreements.

Overall, it can be argued that Cape Winelands Airport would be the most suitable alternate airport destination due to its close proximity to Cape Town International, and meeting all of the requirements in the selected evaluation criteria.

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6 Assessment of CWA's suitability as Destination Alternate Aerodrome to CPT

In order to be the preferred destination alternate aerodrome for CPT, MAI recommends compliance with the requirements of an operational aerodrome as outlined in chapter 4.5 Operational Aerodrome.
The table below evaluates compliance of the infrastructure, facilities, and systems planned for the opening phase PAL 1A for CWA according to the airport master plan dated 15th August 2023. To be classified as an operational aerodrome by aircraft operators, all requirements for basic, planning, and operational aerodrome outlined below should be met.

Colour coding legend:

Colour coding				Meaning
Basic Aerodrome	Planning Aerodrome	Operational Aerodrome		compliant
				compliant with additional remarks
				not compliant
				no data available

Criteria		CWA compliance
Basic Aerodrome		
Aerodrome Availability		As the airport master plan does not specify any operating hours, MAI recommends adjusting the operating hours to the timetable of CPT, so that CWA is available as destination alternate aerodrome. Therefore, the operating hours at CWA should include the time of the earliest arrival at CPT plus the diversion time to CWA and the latest arrival at CPT plus the diversion time to CWA.
Performance requirements		The performance requirements of all aircraft currently operating at CPT, are met at CWA. For more information refer to chapter 5.3 Aircraft Performance.
Air Traffic Services		The airspace CONOPS plans the establishment of an own CTR for CWA, to establish CWA as controlled aerodrome,

		which is needed to serve as a destination alternate aerodrome for IFR flights. The installation of a remote or digital virtual tower solution seems feasible for the foreseen mode of operation. The combined use of the TMA by CPT and CWA seems suitable. The development of instrument flight procedures based on the point merge design methodology for STARs and potential integration of wake RECAT separation procedures allows for efficient use of CWA as destination alternate aerodrome.
Approach and Taxiway Lighting		To achieve the lowest possible system decision height (DH) for an ILS Cat 1 approach, a Precision Approach Category I Lighting System needs to be available, which provides at least centre line alignment guidance for a distance of 900 m before the threshold and a crossbar of 30 m at a distance of 300 m before the threshold. Due to the displacement of CWA's runway threshold, threshold identification lights in flashing white should be installed. Although, not required for a Precision Approach Runway Category I, MAI recommends the installation of runway centre line lights, to enable take-offs with RVRs below 400 m. MAI furthermore recommends the installation of touchdown zone lights, although they are not required for ILS Cat 1 approach operations, as long the aircraft is capable of performing a flight director coupled approach, which is the case for large transport type aircraft. Nevertheless, touchdown zone lights significantly increase aerodrome safety. Although only taxiway edge lights need to be provided for operations at night when taxiway centre line lights are not installed,

		MAI recommends the installation of both, to increase safety on the manoeuvring area. According to the airport master plan and the airspace CONOPS report, MAI identifies that all above stated requirements have been considered.
Communication Systems		The following systems are planned for in the airport master plan: ▪ Wireless Telecommunications/Radio systems (VHF/UHF) ▪ Voice Communication Control System (VCCS) ▪ Digital Voice Recording System (DVRS) ▪ Crash Alarm System (CAS) ▪ Digital Automatic Terminal Information Service (D-ATIS) ▪ Aeronautical Message Handling System (AMHS) These systems support the use case as destination alternate aerodrome.
Meteorological Systems		The meteorological systems planned for CWA in the airport master plan are well suited for the operational use as destination alternate. An AWOS system for a precision approach runway is required, as well as at least one IRVR sensor, as MAI recommends an ILS Cat 1 approach. Although not required for ILS Cat 1 operations, MAI recommends the installation of a ceilometer. CWA should publish the following weather reports, to be usable as destination alternate aerodrome: ▪ METAR including TREND information, preferably published on a D-ATIS ▪ TAF ▪ Airport Weather Warning (AWW)

	Runway strength		The airport master plan does not specify a PCN number for the runway or taxiway system. However, the runway is planned to accommodate all relevant aircraft in a diversion scenario, which leads to the assumption that the runway and taxiway system at CWA can support all relevant aircraft.
	Navigation Aid and Approach Procedure		The proposed instrument flight procedures defined in the airspace CONOPS report for runway 01/19 are well suitable for the operation of CWA as destination alternate aerodrome. Planned approach procedures include, RNP and ILS approaches with RNAV STARs. For the development of the RNP approaches, MAI recommends the definition of RNP approaches with LNAV/VNAV minimum, as a minimum requirement, and suggests to further investigate the possibility of defining an RNP approach with LPV minimum, which would allow for even lower approach weather minima. Although, the airspace CONOPS discusses the installation of a DVOR/DME navaid for the establishment of an additional non-precision approach procedure besides an RNP approach, MAI could not identify a requirement for such an approach procedure for the use of CWA as destination alternate aerodrome. However, a DME needs to be installed to allow for ILS Cat 1 approach operations. The DME can also be collocated with the ILS, as is the case at most aerodromes.
	Emergency Services		CWA should offer rescue and firefighting services according to ICAO RFFS category 9, to serve as a destination alternate aerodrome for all flights operating to CPT. The airport master plan complies with this requirement.
Planning Aerodrome			

	Aircraft Refueling Services		The airport master plan considers fuel facilities for both commercial air traffic and general aviation. A bulk fuel depot for intake, storage and dispense of JET A1 fuel is considered from which bowser trucks are supplied. In a diversion scenario, the availability of sufficient fuel trucks is crucial for an efficient aircraft turnaround process. The number of required fuel trucks should therefore be planned in accordance with the diversion scenario planned in the document 23-05-24_NACO_Diversion Scenario Planning (Final).pdf.
Operational Aerodrome			
	Ground Handling Services		
	Aircraft Parking		The airport master plan and the diversion scenario analysis recommend two categories for the parking of commercial aircraft (other than cargo aircraft, which are parked on the cargo apron): ▪ Parking of scheduled aircraft on parking aprons ▪ Parking of diverted aircraft on a taxiway parallel to the runway (when all apron parking stands are occupied) The airport masterplan's rationale for parking diverted aircraft nose-to-tail on a taxiway is the higher cost of maintaining a larger apron that can accommodate diverted traffic in addition to scheduled traffic. For this reason, diverted traffic should be parked nose-to-tail on the taxiway. MAI cannot recommend such a layout for the following reasons, as we expect too many operational restrictions in the event of diversion traffic: ▪ In principle, the nose-to-tail parking of aircraft on a taxiway is only suitable for long-term parking or storage of aircraft,

			as frequently happened during the covid-19 pandemic. ▪ Aircraft cannot be ground serviced in this arrangement as there is not enough space available on the taxiway. This mainly refers to the space available next to the aircraft, so no ground service equipment can be placed here. This also means that passengers cannot disembark on the taxiway. ▪ During a diversion event, however, the aim of the airlines is either to fly to the intended aerodrome after a short turnaround with refuelling services only, or to have a normal turnaround process at CWA which includes passenger disembarkation and full servicing of the aircraft. Parking nose-to-tail on a taxiway is not suitable for these scenarios, as parked aircraft block each other. ▪ In the layout of the airport master plan, parking diverted aircraft on the taxiway parallel to the runway, results in the requirement of a turning pad on both runway ends, otherwise an aircraft can not use full runway length for take-off. To serve the foreseen use as destination alternate aerodrome, CWA should reserve sufficient space for diverted aircraft on the apron, as parking these aircraft on taxiways seems to be not operationally feasible. After discussion of the above mentioned recommendations, CWA agreed to change the airport layout by implementing turn pads at the runway ends and paved surfaces next to the taxiway, which can accommodate GSE. Therefore, this criteria is considered to be met.
	Tug Services		As the apron layout at CWA is planned as nose-in parking stands, pushback trucks are needed. Sufficient pushback tracks suitable for the specific types of aircraft at CWA should therefore be planned for. The required GSE should be planned according

			to the traffic forecast considering downtimes of GSE. For planning one can assume that GSE has one day of scheduled and two days of unscheduled maintenance per year.
	Load/Unload Assistance		As most aircraft currently planned to use CWA as destination alternate, are loaded with ULDs (except B737), sufficient baggage dollies, tugs, and high-lifter are required. Furthermore, conveyor belts are needed for bulk loading. The airport master plan sized the baggage handling system according to the expected passenger demand. The same should be done for the required number of GSE for loading and unloading, considering downtimes of GSE.
	Ground Power Unit		At least one operational Ground Power Unit (GPU) needs to available for every commercial aircraft parking stand, capable of supplying the respective aircraft type, typically with 115V AC at 400 Hz. The power required by aircraft depend on their size: ▪ Narrow-body: 1 x 90 kVA ▪ Wide-body: 2 x 90 kVA ▪ A380: 4 x 90 kVA Ground power for aircraft can be provided using mobile GPUs or fixed electrical ground power (FEGP). MAI recommends planning for FEGP available at the contact stands and the apron stands as well, as they provide the following advantages: ▪ No need to refuel mobile GPUs ▪ Less workload for ground crew: no need to physically move mobile GPUs, no need to manually start the GPU ▪ Reduced maintenance costs ▪ Better efficiency

			When planning for mobile GPUs, maintenance and downtimes should be considered. The airport master plan indicates, that FEGP are foreseen, as the power demand for the airport has been calculated accordingly. Furthermore, CWA indicated that electrical GPUs are planned for.
	Preconditioned Air Unit		To allow for APU shutdown during the ground turnaround of an aircraft, MAI recommends the installation of preconditioned air units (PCA). Besides saving fuel, PCA systems reduce noise and air pollution at the airport. PCA units should be planned for contact stands. The airport master plan indicates, that PCA systems are foreseen, as the power demand for the airport has been calculated accordingly. Furthermore, CWA indicated that mobile PCA units are planned for apron stands as well.
	Air Starter Unit		An air starter unit (ASU) is required for engine start in cases an aircraft is dispatched with its APU inoperative. Although this is rare, CWA must have an ASU available for the most demanding aircraft type (B777 & A380), otherwise the aerodrome cannot be planned as destination alternate in such a case. CWA indicated that electrical air starter units are planned.
	Lavatory Service Water Service Aircraft Cleaning Service		Lavatory service, water service, and aircraft cleaning service are required during the turnaround process of an aircraft. While the airport master plan sized the facilities needed to provide these services, seizing of the number of GSE vehicles is still due. As valid for other GSE, downtime due to scheduled and unscheduled maintenance needs to be considered.

	Inflight Catering Service		An operational aerodrome, where a flight can be completed, should provide an inflight catering service, to supply the aircraft with catering for the subsequent departure. An inflight catering facility has been considered in the airport master plan and is planned based on the number of departing aircraft and estimated number of trays per departing aircraft. However, it should be noted, that sufficient capacity should be available for additional orders from diverted aircraft. For efficient handling of diversions, commercial agreements between the airline and the catering company should be made in advance.
	Miscellaneous		
	Overnight/Long-Term Parking Space		Non-operational aircraft parking positions have been taken into consideration in the airport master plan. These stands are intended for parking aircraft for a longer period without passenger embarking or disembarking. In contrast to diverted aircraft, long-term parking could also be located on the parallel taxiway nose-to-tail as currently planned for diverted aircraft.
	Aircraft Maintenance Repair and Overhaul Services		In order to be able to classify CWA as an operational aerodrome and thus establish it as the preferred alternate airport to CPT, at least line maintenance services should be offered at CWA. The reason for this is that a flight may be finalised at an operational aerodrome and the diverted traffic can depart from CWA on its return flight. As most long-haul flights are operated under EDTO (or ETOPS) rules, an ETOPS check is required before each flight, which can only be carried out by certified maintenance personnel. As the airport master plan considers the space for MRO facilities, MRO companies need to be attracted to operate at CWA.

	Overnight Accommodations		An airport hotel is foreseen within the airport master plan. It should be sized to accommodate passengers from diverted traffic as well.
	Passenger Handling Services		
	Contracted Passenger Handling Company		Airlines planning CWA as destination alternate aerodrome should have contractual agreements in place with a passenger handling company at CWA to dispatch the aircraft in a diversion event. This includes agreements for special need passengers such as PRMs.
	Baggage Handling		The baggage handling system (BHS) and supporting operations have been sized according to the traffic forecasts. However, it should be noted that it appears that diversion traffic has not been considered in this approach. In a diversion event, the BHS might not have sufficient capacity.
	Immigration, Border Control, and Customs		Space for immigration processes has been considered in the airport master plan for passport control inbound and outbound. Space for customs has been also foreseen. Both are important to classify CWA as an operational aerodrome, which means a flight can be completed at CWA. Immigration and border control needs to be available during a diversion event.
	Security Control Facilities		Security control lanes have been seized according to the traffic forecasts and consider potential segregated control lanes for domestic and international passengers. Besides considering the space needed for security control lanes, a security concept on a master plan level has been developed which satisfies the needs of an operational aerodrome.
	Medical Facilities		The availability of sufficient medical facilities in the vicinity of CWA leads to the conclusion that CWA is also suitable as an alternate aerodrome for medical emergencies. The planned medical facilities

			in the airport city of CWA support this conclusion. Emergency plans with the medical facilities in the vicinity should be prepared to streamline processes for diversions due to medical emergencies onboard an aircraft.

Conclusion:
The aim of CWA is to establish itself as the preferred destination alternate aerodrome for CPT. For this purpose, MAI recommends providing infrastructure, systems and services to be categorised by airlines as an operational aerodrome. This study therefore analysed whether the current plans for the future CWA airport in accordance with airport master plan planning phase PAL 1A meet the requirements of an operational aerodrome.
The study carried out confirms that the airport master plan planning phase PAL 1A allows the conclusion that CWA will be classified as an operational aerodrome by airlines. MAI has addressed further recommendations concerning the apron and taxiway layout, that have been agreed to be implemented for further planning. Additionally, MAI recommends carrying out an airside (rapid) simulation to review and optimise the currently planned apron and taxiway layout, to identify bottlenecks and to dimension the required GSE in a diversion scenario.

7 Weather Analysis

7.1 Pre-Flight Planning Minima

During the flight planning process, an aircraft operator needs to consider weather minima when selecting alternate aerodromes. These pre-flight planning minima differ with different regulators, the foreseen use of the aerodrome, and with the equipment of the aerodrome. An alternate aerodrome may only be specified in the operational flight plan, if the latest available meteorological reports and forecasts indicate that the weather conditions will be better than the defined pre-flight planning minima.
As pre-flight planning minima differ between the foreseen use of the aerodrome and as well with different regulations, the following provides a brief overview of the different applicable pre-flight planning minima:

7.1.1 Destination Aerodrome

The meteorological reports at the destination aerodrome need to indicate that the weather within plus and minus one hour of the expected time of arrival (ETA) is equal to or better than the applicable aerodrome landing minima, which are based on the equipment and approach classification of the aerodrome.
If the meteorological reports indicate that the weather will below the applicable landing minima, an aircraft operator needs to plan with two destination alternate aerodromes.

Pre-Flight Planning Minima for CPT and CWA as Destination Aerodrome:

Considering the designation of CPT or CWA as destination aerodrome, the weather needs to be forecasted better than the applicable landing minima at these aerodromes, as indicated below:

Note: All information shown below is based on the airport master plan for CWA dated 15th August 2023. To support the decision, whether a Cat 1 or Cat 3 instrument landing system should be considered at CWA, both cases are considered. Since no obstacle assessment indicating applicable obstacle clearance heights for CWA are available, it considered that the standard approach system minima are applicable. Cat 3 minima may differ with aircraft type and aircraft operator low visibility approval. The table below shows the lowest possible decision height and RVR for the current state of art for an aircraft with a fail operational flight guidance system, as is the case for modern airliners.

Destination Aerodrome	Ceiling	RVR/Visibility
CPT	0 ft	75 m
CWA Cat 3	0 ft	75 m
CWA Cat 1 only	200 ft	550 m

7.1.2 Destination Alternate Aerodrome and Fuel ERA Aerodrome

The pre-flight planning minima for destination alternate aerodromes and fuel ERA aerodromes differ with ICAO based, EASA, FAA, and Australian CASA regulations. As the application of the respective regulation depends on the country in which the aircraft operator has registered its airline operating certificate, all four regulations are important when assessing the suitability of CWA as the preferred destination alternate aerodrome for CPT.

- ICAO Pre-Flight Planning Minima dictate that an aircraft operator shall only select an aerodrome as destination alternate or fuel ERA aerodrome, when appropriate weather reports or forecasts, or any combination thereof, indicate that, during a period commencing one hour before and ending one hour after the estimated time of arrival at the aerodrome, the weather conditions will be at or above the planning minima outlined in the table below:[23]

Planned type of approach	Planning minima
ILS Cat 3 and Cat 2	ILS Cat 1
ILS Cat 1	Non-precision (next higher available)
Non-precision	Non-precision plus: ▪ MDH + 200 ft ▪ Visibility + 1000 m
Circling	Circling

- EASA Pre-Flight Planning Minima dictate that an aircraft operator shall only select an aerodrome as destination alternate or fuel ERA aerodrome, when appropriate weather reports or forecasts, or any combination thereof, indicate that, during a period commencing one hour before and ending one hour after the estimated time of arrival at the aerodrome, the weather conditions will be at or above the planning minima outlined in the table below:[24]
  In this context, EASA distinguishes between Type A and Type B instrument approaches, which are defined as follows.
  - Type A instrument approach means an instrument approach with a MDH at or above 250 ft.
  - Type B instrument approach means an instrument approach with a MDH below 250 ft.

[23]Reference:
- ICAO Doc 9976 Flight Planning and Fuel Management (FPFM) Manual, 1st Edition, 2015

[24] Reference:
- EASA AMC & GM to Part-CAT AMC9 CAT.OP.MPA.182, Issue 2, Amendment 23

Available Approaches at Aerodrome	Ceiling	RVR or Visibility
Two or more Type B approaches to two separate runways available	DH + 100 ft	RVR + 300 m
One Type B approach available	DH + 150 ft	RVR + 450 m
One Type A approach with system minimum of 200 ft or less available	DH + 200 ft	RVR/VIS + 800 m
Two or more Type A approaches based on separate navigation aids available	DH or MDH +200 ft	RVR/VIS + 1000 m
One Type A approach available	DH or MDH + 400 ft	RVR/VIS + 1500 m
Circling approach available	MDH + 400 ft	VIS + 1500 m

- FAA Pre-Flight Planning Minima dictate that an aircraft operator shall only select an aerodrome as destination alternate or fuel ERA aerodrome, when appropriate weather reports or forecasts, or any combination thereof, indicate that, during a period commencing one hour before and ending one hour after the estimated time of arrival at the aerodrome, the weather conditions will be at or above the planning minima outlined in the table below:[25]

Planned type of approach	Ceiling	RVR or Visibility
Precision approach	600 ft	2 SM (~ 3219 m)
Non-precision approach	800 ft	2 SM (~ 3219 m)

- Australian (CASA) Pre-Flight Planning Minima dictate that an aircraft operator shall only select an aerodrome as destination alternate or fuel ERA aerodrome, when appropriate weather reports or forecasts, or any combination thereof, indicate that, during a period commencing 30 minutes before and ending 30 minutes after the estimated time of arrival at the aerodrome, the weather conditions will be at or above the planning minima outlined in the table below:[26]

[25]Reference:
- 14 CFR § 91.169 IFR flight plan: Information required

[26]Reference:
- Australian Civil Aviation Authority, Part 121 Manual of Standards Compilation No. 2, 2024

Available Approaches at Aerodrome	Ceiling	RVR or Visibility
Two or more instrument approaches to different runways, of which at least one is a Cat 2 or Cat 3 approach	Not required	Cat 1 RVR
Two or more instrument approaches to different runways	DH or MDH + 200 ft of 2nd lowest approach minima	RVR/VIS + 800 m of 2nd lowest approach minima
Single runway with at least one instrument approach available	DH or MDH + 400 ft of 2nd lowest approach minima	RVR/VIS + 1500 m of 2nd lowest approach minima
No instrument approach available	Minimum safe altitude + 500 ft	8 km

7.1.3 Pre-Flight Planning Minima for CWA as Destination Alternate Aerodrome or Fuel ERA

Considering the specification of CWA as destination alternate aerodrome for CPT, or as fuel ERA, the following pre-flight planning minima would be applicable:

Note: All information shown below is based on the airport master plan for CWA dated 15th August 2023. To support the decision, whether a Cat 1 or Cat 3 instrument landing system should be considered at CWA, both cases are considered. Since no obstacle assessment indicating applicable obstacle clearance heights for CWA are available, it considered that the standard approach system minima are applicable.

Applicable regulation for aircraft operator	ILS approach category at CWA	Ceiling	RVR or Visibility
ICAO based	Cat 1	250 ft[27]	750 m
	Cat 2/3	200 ft	550 m
EASA	Cat 1	350 ft	1000 m
	Cat 2/3	350 ft	1000 m
FAA	Cat 1	600 ft	3219 m
	Cat 2/3	600 ft	3219 m
CASA	Cat 1	650 ft[28]	2250 m
	Cat 2	600 ft	2050 m
	Cat 3	500 ft	1800 m

Analysing the table above, it can be stated that only for aircraft operators registered in states which base their pre-flight planning minima on ICAO or for Australian aircraft operators, the introduction of a Cat 3 instrument landing system at CWA leads to advantages over a Cat 1 instrument landing system. For EASA and FAA regulations, a Cat 3 instrument landing system at CWA does not allow for lower pre-flight planning minima for its use as a destination or fuel ERA alternate aerodrome compared to the installation of a Cat 1 instrument landing system at CWA. For a list of which airline flying to CPT is subject to which pre-flight minima requirements, refer to chapter 7.5 Results for actual CPT timetable.

[27] Assumption: LOC DME approach (system minima: MDH 200 ft; RVR 750 m) available and published
[28] Assumption: LOC DME approach (system minima: MDH 200 ft; RVR 750 m) available and published

7.1.4 Take-Off Alternate Aerodrome and En-Route Alternate Aerodrome

The meteorological reports at a take-off alternate aerodrome or en-route alternate aerodrome need to indicate that the weather within plus and minus one hour of the expected time of use is equal to or better than the applicable aerodrome landing minima, taking into consideration any limitation related to one-engine-inoperative operations.
Any limitation resulting from the consideration of one-engine-inoperative operations, depend on the aircraft type operated. However, typically, the failure of one engine leads to a degradation of the aircraft's approach capability from a fail operational to a fail passive system, meaning the aircraft is not capable of flying Cat 3b approaches without decision height anymore. Typically, the aircraft is then restricted to Cat 3a approaches, as indicated in the table below:

Note: All information shown below is based on the airport master plan for CWA dated 15th August 2023. To support the decision, whether a Cat 1 or Cat 3 instrument landing system should be considered at CWA, both cases are considered. Since no obstacle assessment indicating applicable obstacle clearance heights for CWA are available, it considered that the standard approach system minima are applicable.

Destination Aerodrome	Ceiling	RVR/Visibility
CPT	50 ft	200 m
CWA Cat 3	50 ft	200 m
CWA Cat 1 only	200 ft	550 m

7.2 Weather Minima from Airline Operator Decision Making Models

In addition to the regulatory requirements which specify the pre-flight planning minima for aerodromes as outlined in chapter 7.1 Pre-Flight Planning Minima, major airline operators have usually defined further requirements for safe and efficient planning within their decision-making models.
As previously mentioned in chapter 3 Introduction to Airline Decision Making Models for Alternate Aerodrome Planning, a prerequisite of most models is, that the alternative plan needs to always be associated without any risks. Risks in this context are defined individually by each operator and usually comprise ceilings and visibilities/RVRs close to the landing minima, strong crosswinds, low visibility procedures in force, thunderstorm activity, etc.
When analysing the suitability of an aerodrome as an alternate aerodrome, it is therefore advisable to not only concentrate on the legal pre-flight planning minima requirements, but also consider the additional requirements most airline operators define.

For the purpose of this analysis, the following weather phenomena, which go beyond the legally applicable pre-flight planning minima are considered a risk:

- Crosswind component greater than 20 kts
- Wind speeds of more than 30 kts
- Thunderstorms (METAR code TS)
- Heavy showers of precipitation (METAR code +SH)
- Hail (METAR code GR)
- Windshear (METAR code WS)

7.3 Methodology

The scope of this weather analysis is to derive the time periods when CWA cannot be planned as a destination alternate aerodrome to CPT. Therefore, this analysis is based on the following research methodology:

Data Acquisition and Processing

In order to carry out a reliable, valid and methodically correct weather analysis, precise weather data is required over a long observation period. AWOS weather reports in METAR format, which are usually published by aerodromes every half hour or hour, are best suited for this purpose. As CWA does not have an AWOS station and MAI does not have any other sufficiently accurate weather reports for such an analysis, an approximation is made in this study using the AWOS reports from CPT. This is valid for three reasons:

- The flight preparation of aircraft operators is based on weather forecasts. For long-haul flights, there are often more than 12 hours between flight planning and arrival at the destination or destination alternate aerodrome, so that these weather forecasts inherently have a certain degree of inaccuracy.
- Due to the close proximity between CPT as a destination aerodrome and CWA as a destination alternate aerodrome, flight dispatchers and flight crews will not plan CWA as a destination alternate aerodrome if the weather forecast for CPT is marginal, but the weather forecast for CWA permits legal planning as a destination alternate aerodrome. This is mainly due to the inaccuracy of the weather forecasts, where it is almost impossible to localize the weather phenomena to within a few miles (the distance between CWA and CPT is just 14 NM). In such an unlikely constellation of weather forecasts, CWA could still be legally planned as a destination alternate aerodrome, but the risk that the weather in CWA will develop as forecasted for CPT is too high for CWA to be declared a valid alternative action in line with the airline operator decision making models (refer to chapter 3 Introduction to Airline Decision Making Models for Alternate Aerodrome Planning).
- The weather comparison study of the South African Weather Services (refer to document Cape Winelands Airport Viability Study Report WCS-RES-REP-001) shows that ground visibility, fog, and cloud bases in CWA behave very similarly to the weather in CPT. This is also suggested by the immediate geographical location. For this reason, it is valid to use the AWOS weather data from CPT in order to calculate the times when CWA cannot be planned as a destination alternate aerodrome for CPT.

Definition of pre-flight planning minima

As stated in chapter 7.1.2 Destination Alternate Aerodrome and Fuel ERA Aerodrome, pre-flight planning minima for CWA as destination alternate aerodrome vary quite significantly with different regulations and for some regulators as well with the approach capability of the aerodrome. Therefore, to identify the recommended approach capability for CWA for its use as destination alternate aerodrome, this analysis considers two cases: ILS Cat 1 or ILS Cat 3 approach available at CWA. The marked pre-flight planning minima below are considered within this study:

Applicable regulation for aircraft operator	ILS approach category at CWA	Ceiling	RVR or Visibility
ICAO based	Cat 1	250 ft[29]	750 m
	Cat 2/3	200 ft	550 m
EASA	Cat 1	350 ft	1000 m
	Cat 2/3	350 ft	1000 m
FAA	Cat 1	600 ft	3219 m
	Cat 2/3	600 ft	3219 m
CASA	Cat 1	650 ft[30]	2250 m
	Cat 2	600 ft	2050 m
	Cat 3	500 ft	1800 m

[29]Assumption: LOC DME approach (system minima: MDH 200 ft; RVR 750 m) available and published
[30]Assumption: LOC DME approach (system minima: MDH 200 ft; RVR 750 m) available and published

Additionally, airline operator requirements for pre-flight planning as outlined in chapter 7.2 Weather Minima from Airline Operator Decision Making Models are considered. Adding both, regulatory and airline operator requirements, results in the weather limitation for destination alternate aerodrome planning for this analysis.

ICAO pre-flight planning minima for CWA as destination alternate aerodrome with consideration of further airline operator requirements:

Cat 1 ILS at CWA:

- Ceiling >= 250 ft
- Visibility >= 750 m

Cat 3 ILS at CWA:

- Ceiling >= 200 ft
- Visibility >= 550 m

- Crosswind component <= 20 kts
- Wind speeds <= 30 kts
- No thunderstorms (METAR code TS)
- No heavy showers of precipitation (METAR code +SH)
- No hail (METAR code GR)
- No windshear (METAR code WS)

EASA pre-flight planning minima for CWA as destination alternate aerodrome with consideration of further airline operator requirements:

- Ceiling >= 350 ft
- Visibility >= 1000 m
- Crosswind component <= 20 kts
- Wind speeds <= 30 kts
- No thunderstorms (METAR code TS)
- No heavy showers of precipitation (METAR code +SH)
- No hail (METAR code GR)
- No windshear (METAR code WS)

FAA pre-flight planning minima for CWA as destination alternate aerodrome with consideration of further airline operator requirements:

- Ceiling >= 600 ft
- Visibility >= 3219 m
- Crosswind component <= 20 kts
- Wind speeds <= 30 kts
- No thunderstorms (METAR code TS)
- No heavy showers of precipitation (METAR code +SH)
- No hail (METAR code GR)
- No windshear (METAR code WS)

CASA pre-flight planning minima for CWA as destination alternate aerodrome with consideration of further airline operator requirements:

Cat 1 ILS at CWA:

- Ceiling >= 650 ft
- Visibility >= 2250 m

Cat 3 ILS at CWA:

- Ceiling >= 500 ft
- Visibility >= 1800 m

- Crosswind component <= 20 kts
- Wind speeds <= 30 kts
- No thunderstorms (METAR code TS)
- No heavy showers of precipitation (METAR code +SH)
- No hail (METAR code GR)
- No windshear (METAR code WS)

Weather Analysis against pre-flight minima

Based on the pre-processed historical AWOS data for CPT, each previously defined pre-flight minima are compared against the historical weather data, to derive if an aircraft operator could have planned CWA as a destination alternate aerodrome in the respective time interval. This results in an assessment for every 30 minutes for the past 20 years, if an aircraft operator would have been able to plan CWA as destination alternate aerodrome for CPT.

Percentage share and visualization

Based on the weather analysis against the defined pre-flight planning minima, the percentage share of the events, when CWA could not have been planned as destination alternate aerodrome for CPT, is derived per month and time of day. To allow for reasonable computing times, the time increment has been increased to 2 hours, which is a good compromise between data accuracy and computing time. Finally, the percentage share is visualized in 3D graphs for further use.

7.4 Results with different regulations

7.4.1 Results for ICAO pre-flight minima

7.4.1.1 ICAO pre-flight minima Cat 1 at CWA

The following results are applicable to ICAO pre-flight planning and consider an ILS Cat 1 approach as the best instrument approach at CWA. In this case, the probability of weather events preventing the planning of CWA as a destination alternate averages 3.74% of the year over the last 20 years. The statistical probability of events in which the weather in CWA is below the ICAO pre-flight planning minima varies significantly over the course of the day and year.

As can be assumed, the probability of weather events below the ICAO pre-flight planning minima is highest in the morning and evening hours during the winter months in Cape Town. The highest value is reached in May between 6-8 a.m. LT, during which time the probability of weather below ICAO pre-flight planning minima, including consideration of airline operator requirements, is 9.26%.

A closer look shows that the lowest probabilities are found in the morning hours of the summer months. This is due to the fact that the main determinants for weather events below the ICAO pre-flight planning minima for CWA are low visibilities and low cloud bases in winter and strong winds in summer.

For detailed datasets please refer to Appendix 9.1.

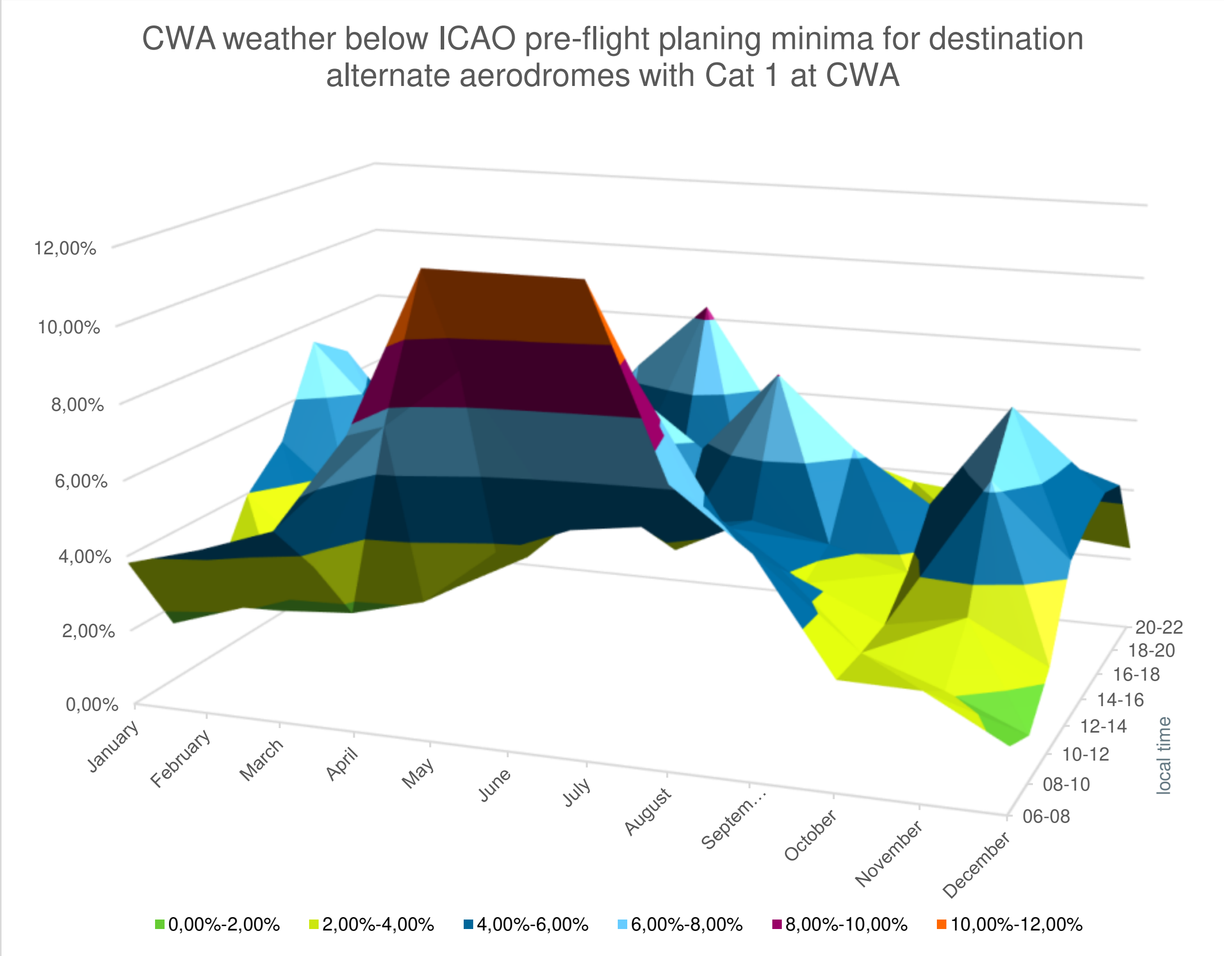


Figure 8 Probabilities for CWA weather below ICAO pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements, statistically derived from data over the past 20 years. Assumption: ILS Cat 1 approach at CWA.[31]

[31] Reference: Munich Airport International GmbH, 2024

As described above, visibilities and/or ceilings below the prescribed ICAO pre-flight planning minima are the main determinants for winter weather events, which do not allow planning of CWA as a destination alternate aerodrome for CPT, as Figure 9 shows below.

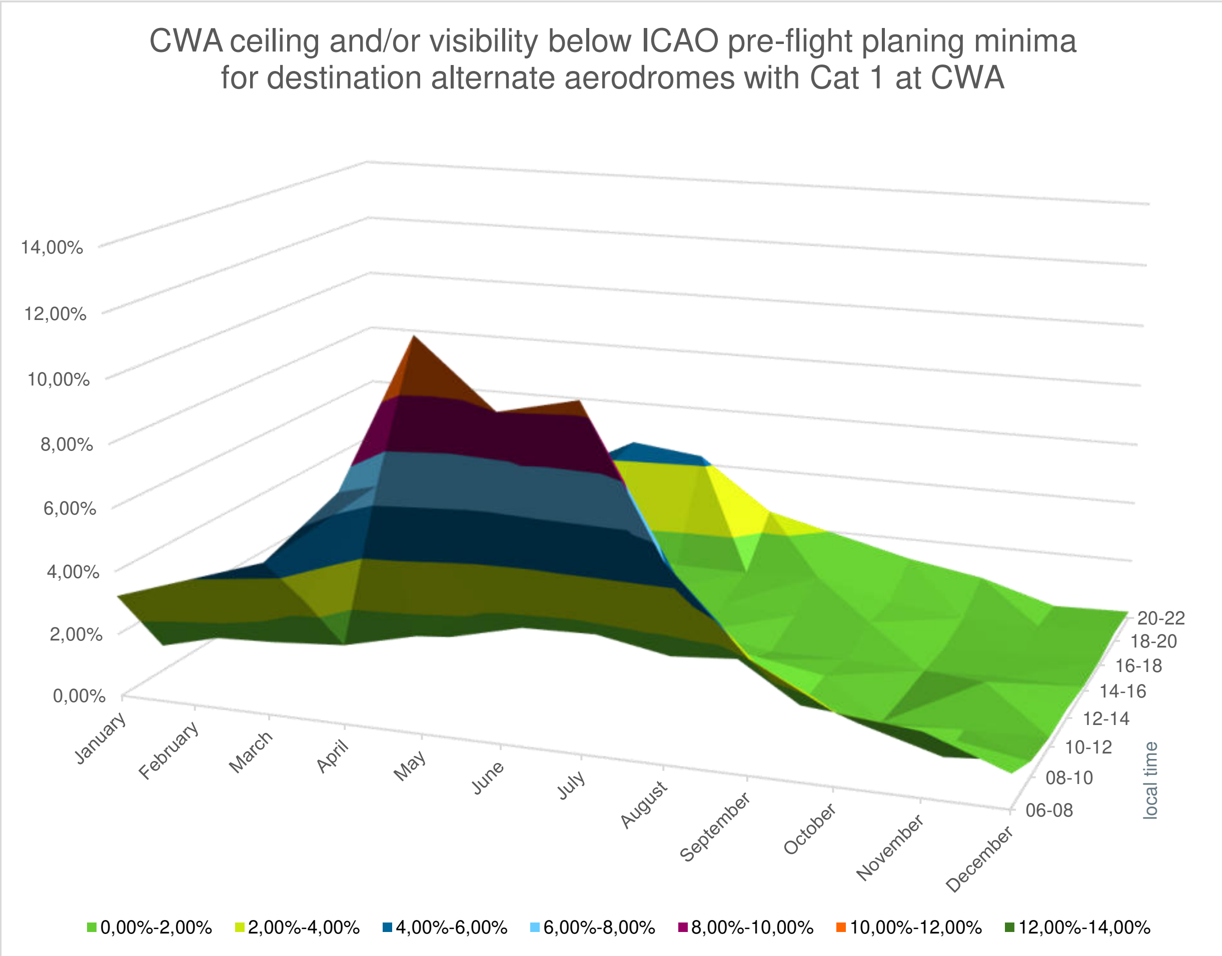


Figure 9 Probabilities for ceiling and/or visibility at CWA below ICAO pre-flight planning minima for destination alternate aerodromes, statistically derived from data over the past 20 years. Assumption: ILS Cat 1 approach at CWA.[32]

[32] Reference: Munich Airport International GmbH, 2024

7.4.1.2 ICAO pre-flight minima Cat 3 at CWA

The following results are applicable to ICAO pre-flight planning and consider an ILS Cat 3 approach as the best instrument approach at CWA. In this case, the probability of weather events preventing the planning of CWA as a destination alternate averages 3.43% of the year over the last 20 years. In contrast to an ILS Cat 1 approach at CWA (compare to 3.74%), the introduction of an ILS Cat 3 approach leads to 0.31% more availability as destination alternate aerodrome, considering ICAO pre-flight minima requirements only. The statistical probability of events in which the weather in CWA is below the ICAO pre-flight planning minima varies significantly over the course of the day and year.

As can be assumed, the probability of weather events below the ICAO pre-flight planning minima is highest in the morning and evening hours during the winter months in Cape Town. The highest value is reached in May between 6-8 a.m. LT, during which time the probability of weather below ICAO pre-flight planning minima, including consideration of airline operator requirements, is 7.50% (compare to 9.26% with Cat 1 only).

A closer look shows that the lowest probabilities are found in the morning hours of the summer months. This is due to the fact that the main determinants for weather events below the ICAO pre-flight planning minima for CWA are low visibilities and low cloud bases in winter and strong winds in summer.

For detailed datasets please refer to Appendix 9.1.

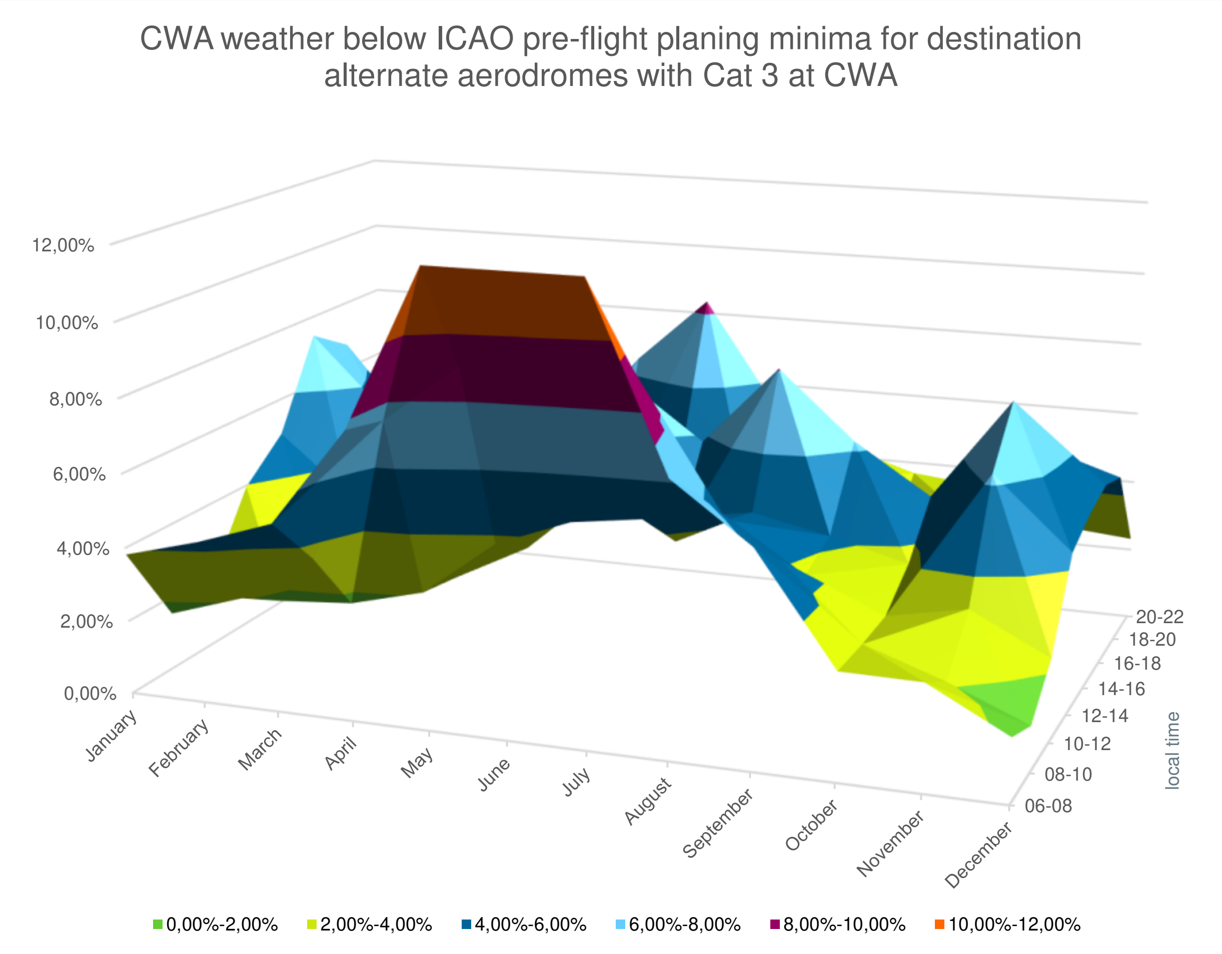


Figure 10 Probabilities for CWA weather below ICAO pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements, statistically derived from data over the past 20 years. Assumption: ILS Cat 3 approach at CWA.[33]

[33] Reference: Munich Airport International GmbH, 2024

As described above, visibilities and/or ceilings below the prescribed ICAO pre-flight planning minima are the main determinants for winter weather events, which do not allow planning of CWA as a destination alternate aerodrome for CPT, as Figure 11 shows below.

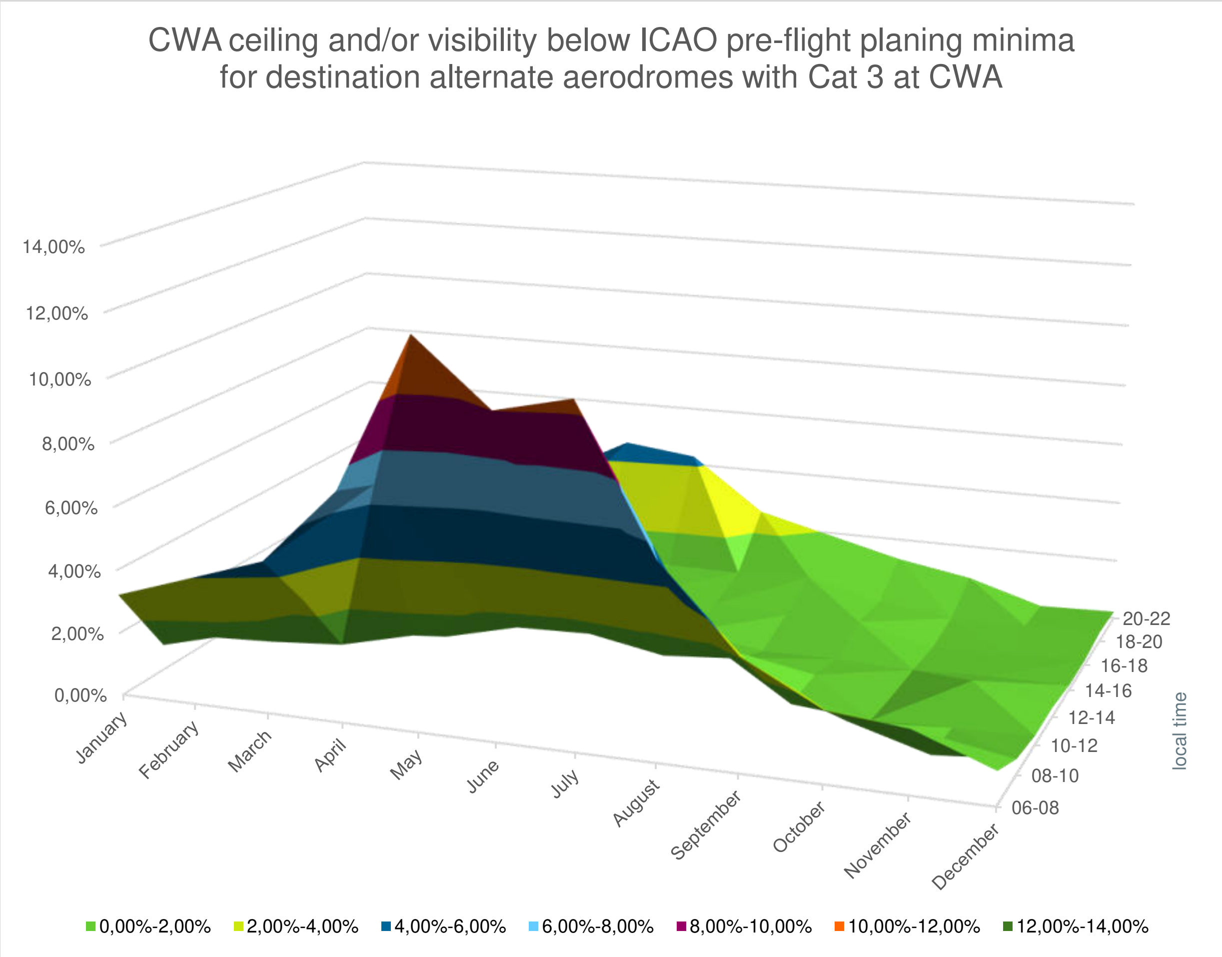


Figure 11 Probabilities for ceiling and/or visibility at CWA below ICAO pre-flight planning minima for destination alternate aerodromes, statistically derived from data over the past 20 years. Assumption: ILS Cat 3 approach at CWA.[34]

[34] Reference: Munich Airport International GmbH, 2024

7.4.2 Results for EASA pre-flight minima

For EASA pre-flight planning minima for destination alternate aerodromes, there is no difference between the availability of an ILS Cat 1 or Cat 3 approach at CWA, as discussed in chapter 7.1.2 Destination Alternate Aerodrome and Fuel ERA Aerodrome. The probability of weather events preventing the planning of CWA as a destination alternate averages 4.04% of the year over the last 20 years, considering EASA pre-flight planning minima requirements. The statistical probability of events in which the weather in CWA is below the EASA pre-flight planning minima varies significantly over the course of the day and year.

As can be assumed, the probability of weather events below the EASA pre-flight planning minima is highest in the morning and evening hours during the winter months in Cape Town. The highest value is reached in May between 6-8 a.m. LT, during which time the probability of weather below EASA pre-flight planning minima, including consideration of airline operator requirements, is 11.22%.

A closer look shows that the lowest probabilities are found in the morning hours of the summer months. This is due to the fact that the main determinants for weather events below the EASA pre-flight planning minima for CWA are low visibilities and low cloud bases in winter and strong winds in summer.

For detailed datasets please refer to Appendix 9.1.

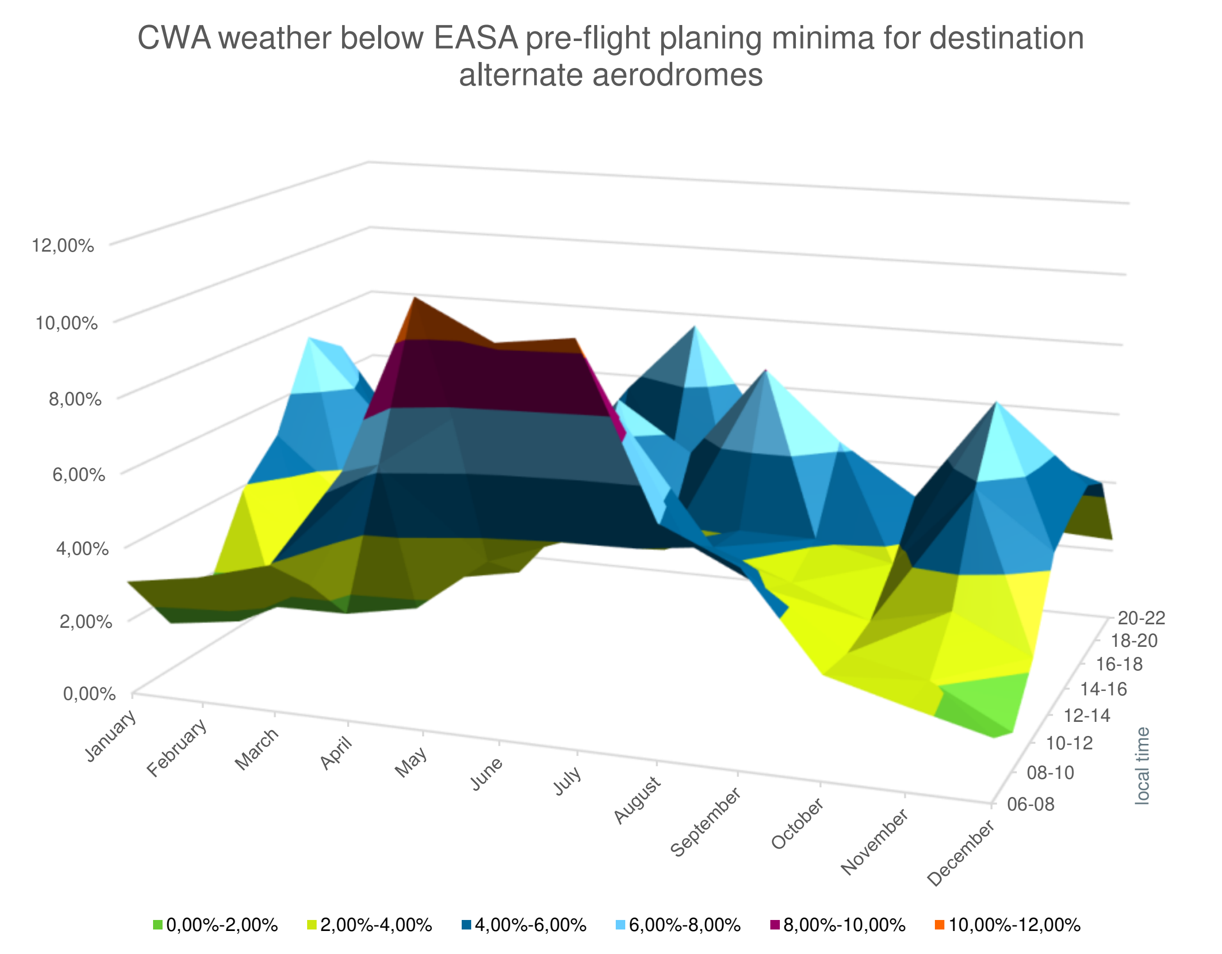


Figure 12 Probabilities for CWA weather below EASA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements, statistically derived from data over the past 20 years. For EASA pre-flight planning minima, there is no difference between ILS Cat 1 or Cat 3 available at CWA.[35]

[35] Reference: Munich Airport International GmbH, 2024

As described above, visibilities and/or ceilings below the prescribed EASA pre-flight planning minima are the main determinants for winter weather events, which do not allow planning of CWA as a destination alternate aerodrome for CPT, as Figure 13 shows below.

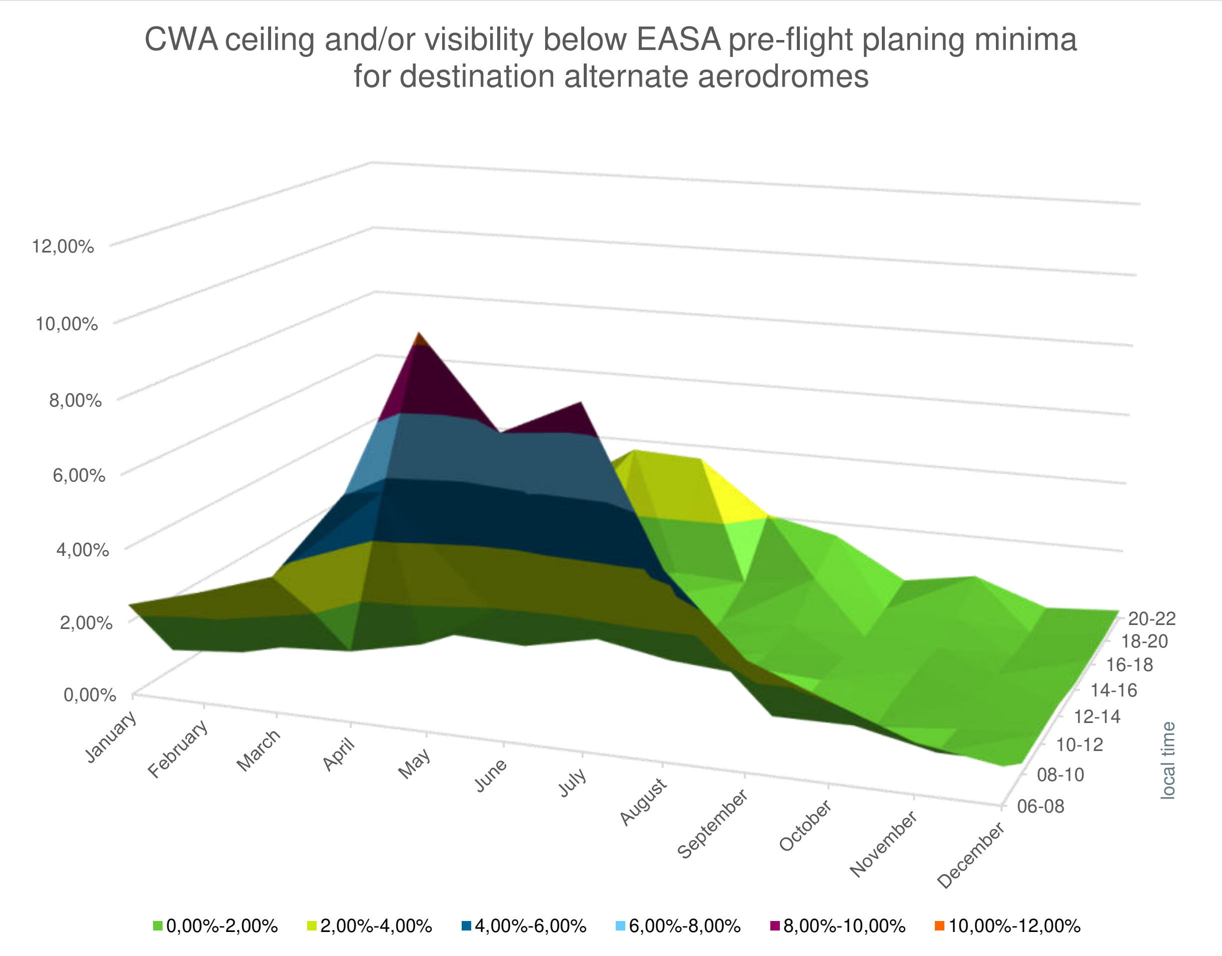


Figure 13 Probabilities for ceiling and/or visibility at CWA below EASA pre-flight planning minima for destination alternate aerodromes, statistically derived from data over the past 20 years. For EASA pre-flight planning minima, there is no difference between ILS Cat 1 or Cat 3 available at CWA.[36]

[36] Reference: Munich Airport International GmbH, 2024

7.4.3 Results for FAA pre-flight planning minima

For FAA pre-flight planning minima for destination alternate aerodromes, there is no difference between the availability of an ILS Cat 1 or Cat 3 approach at CWA, as discussed in chapter 7.1.2 Destination Alternate Aerodrome and Fuel ERA Aerodrome. The probability of weather events preventing the planning of CWA as a destination alternate according to FAA pre-flight planning minima averages 5.83% of the year over the last 20 years, considering FAA pre-flight planning minima requirements. In comparison to the analysis considering EASA pre-flight planning minima, this is an increase of approximately 44%. Whereas limits for wind speeds and weather threats (thunderstorms, heavy shower of precipitation, hail, and windshear) are identical for the EASA and FAA analysis, the significant difference lies with the different requirements for visibility and ceiling. Whereas EASA allows for notably lower ceilings and visibilities in the pre-flight planning stage, FAA imposes more stringent requirements on these values, which explains the different results between both analysis.
As for EASA, the probability of weather events below the FAA pre-flight planning minima is highest in the morning and evening hours during the winter months in Cape Town. The highest value is reached in June between 6-8 a.m. LT, during which time the probability of weather below FAA pre-flight planning minima, including consideration of airline operator requirements, is 16.71% (compare to 10.22% for EASA).
A closer look shows that the lowest probabilities are found in the morning hours of the summer months, as with EASA. This is due to the fact that the main determinants for weather events below the FAA pre-flight planning minima for CWA are low visibilities and low cloud bases in winter and strong winds in summer.
For detailed datasets please refer to Appendix 9.1.

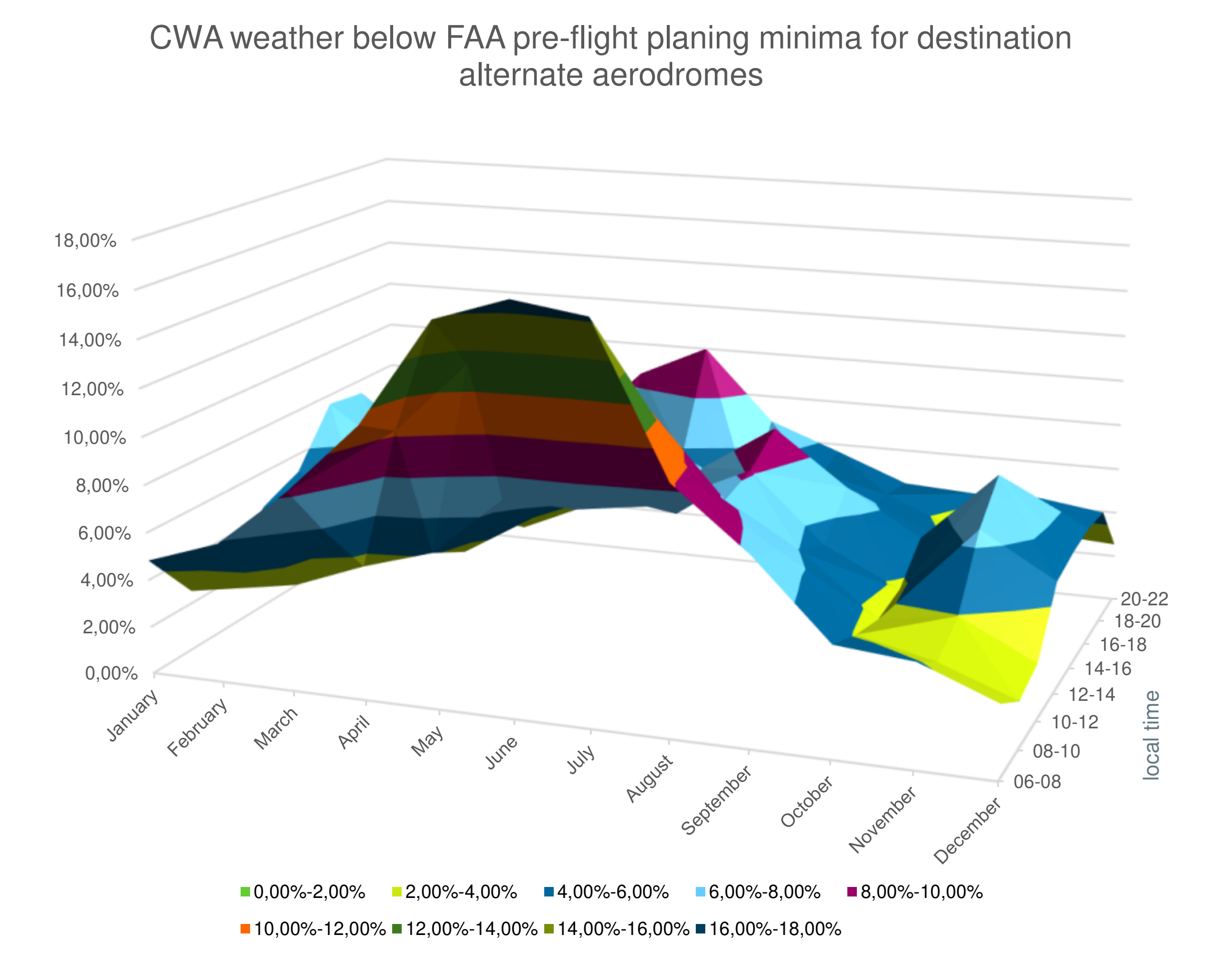


Figure 14 Probabilities for CWA weather below FAA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements, statistically derived from data over the past 20 years. For FAA pre-flight planning minima, there is no difference between ILS Cat 1 or Cat 3 available at CWA.[37]

[37] Reference: Munich Airport International GmbH, 2024

As described above, visibilities and/or ceilings below the prescribed FAA pre-flight planning minima are the main determinants for winter weather events, which do not allow planning of CWA as a destination alternate aerodrome for CPT, as Figure 15 shows below.

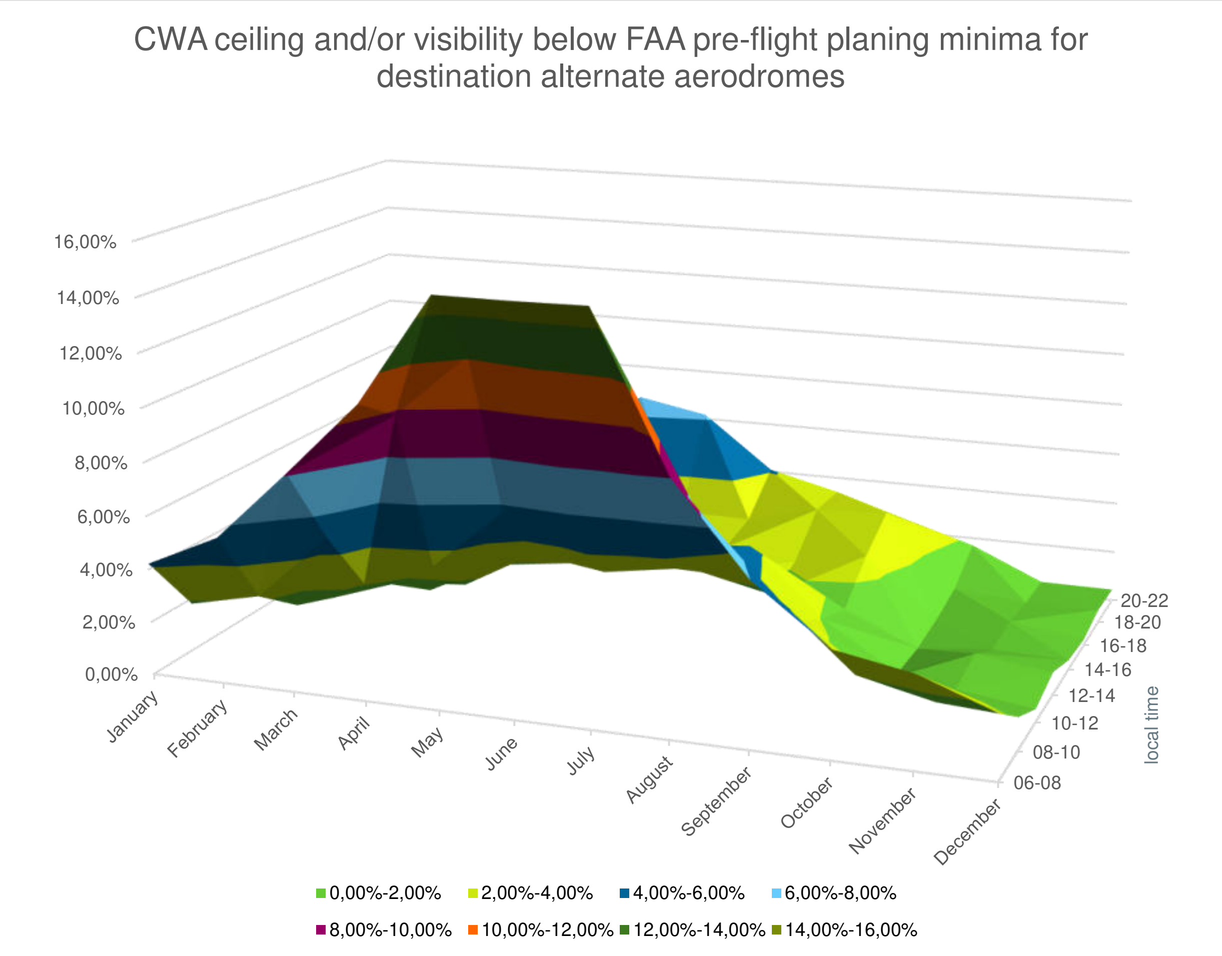


Figure 15 Probabilities for ceiling and/or visibility at CWA below FAA pre-flight planning minima for destination alternate aerodromes, statistically derived from data over the past 20 years. For FAA pre-flight planning minima, there is no difference between ILS Cat 1 or Cat 3 available at CWA.[38]

[38] Reference: Munich Airport International GmbH, 2024

7.4.4 Results for CASA pre-flight minima

7.4.4.1 CASA pre-flight minima Cat 1 at CWA

Although, CWA indicated that there is currently no airline traffic from Australia to CPT, the following information on applicable Australian CASA pre-flight planning minima requirements is added for completeness, as there used to be flights from Australia to CPT in the past.

The following results are applicable to CASA pre-flight planning and consider an ILS Cat 1 approach as the best instrument approach at CWA. In this case, the probability of weather events preventing the planning of CWA as a destination alternate averages 5.35% of the year over the last 20 years. The statistical probability of events in which the weather in CWA is below the CASA pre-flight planning minima varies significantly over the course of the day and year.
As can be assumed, the probability of weather events below the CASA pre-flight planning minima is highest in the morning and evening hours during the winter months in Cape Town. The highest value is reached in May between 6-8 a.m. LT, during which time the probability of weather below ICAO pre-flight planning minima, including consideration of airline operator requirements, is 15.08%.
A closer look shows that the lowest probabilities are found in the morning hours of the summer months. This is due to the fact that the main determinants for weather events below the CASA pre-flight planning minima for CWA are low visibilities and low cloud bases in winter and strong winds in summer.
For detailed datasets please refer to Appendix 9.1.

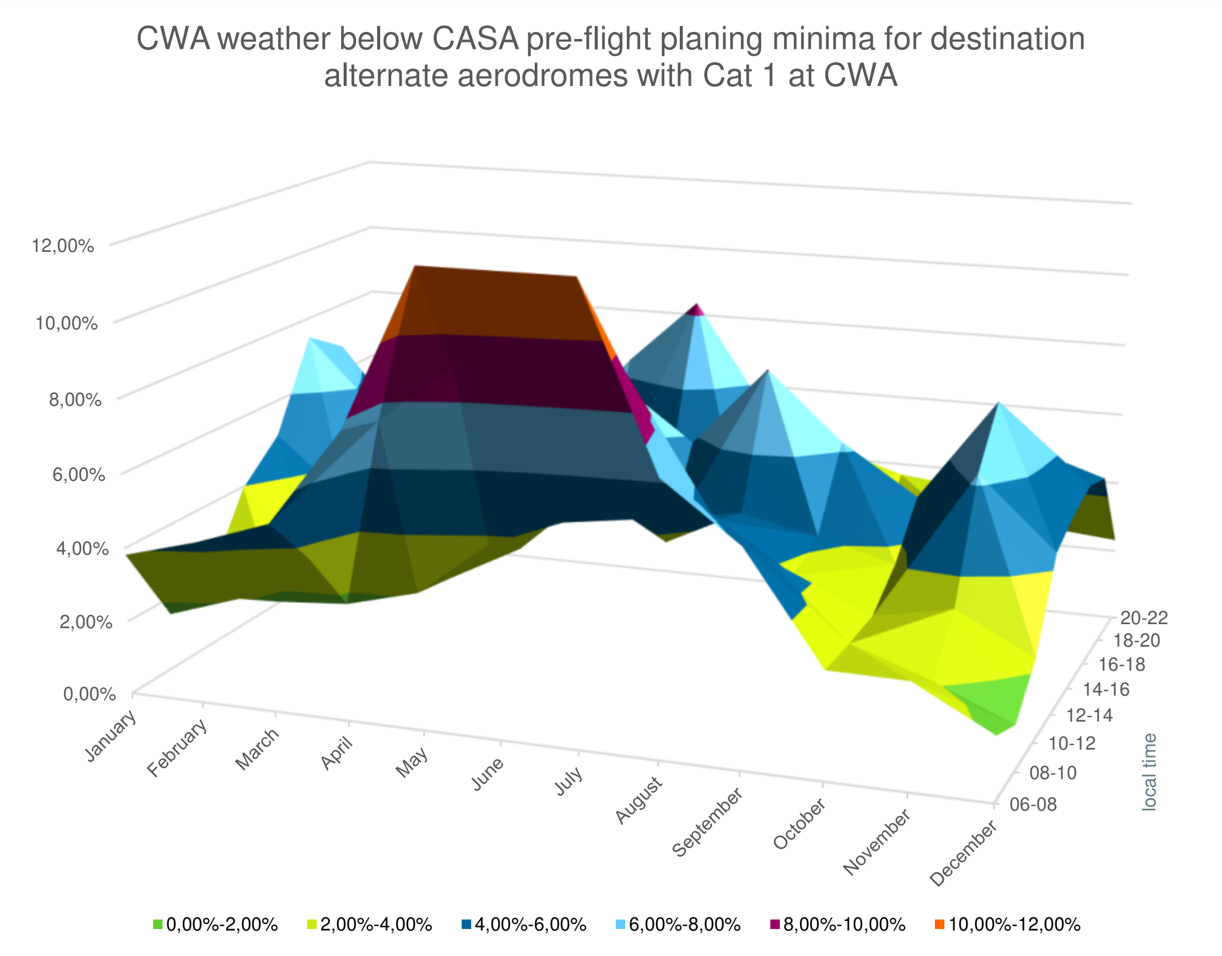


Figure 16 Probabilities for CWA weather below CASA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements, statistically derived from data over the past 20 years. Assumption: ILS Cat 1 approach at CWA.[39]

[39] Reference: Munich Airport International GmbH, 2024

As described above, visibilities and/or ceilings below the prescribed CASA pre-flight planning minima are the main determinants for winter weather events, which do not allow planning of CWA as a destination alternate aerodrome for CPT, as Figure 17 shows below.

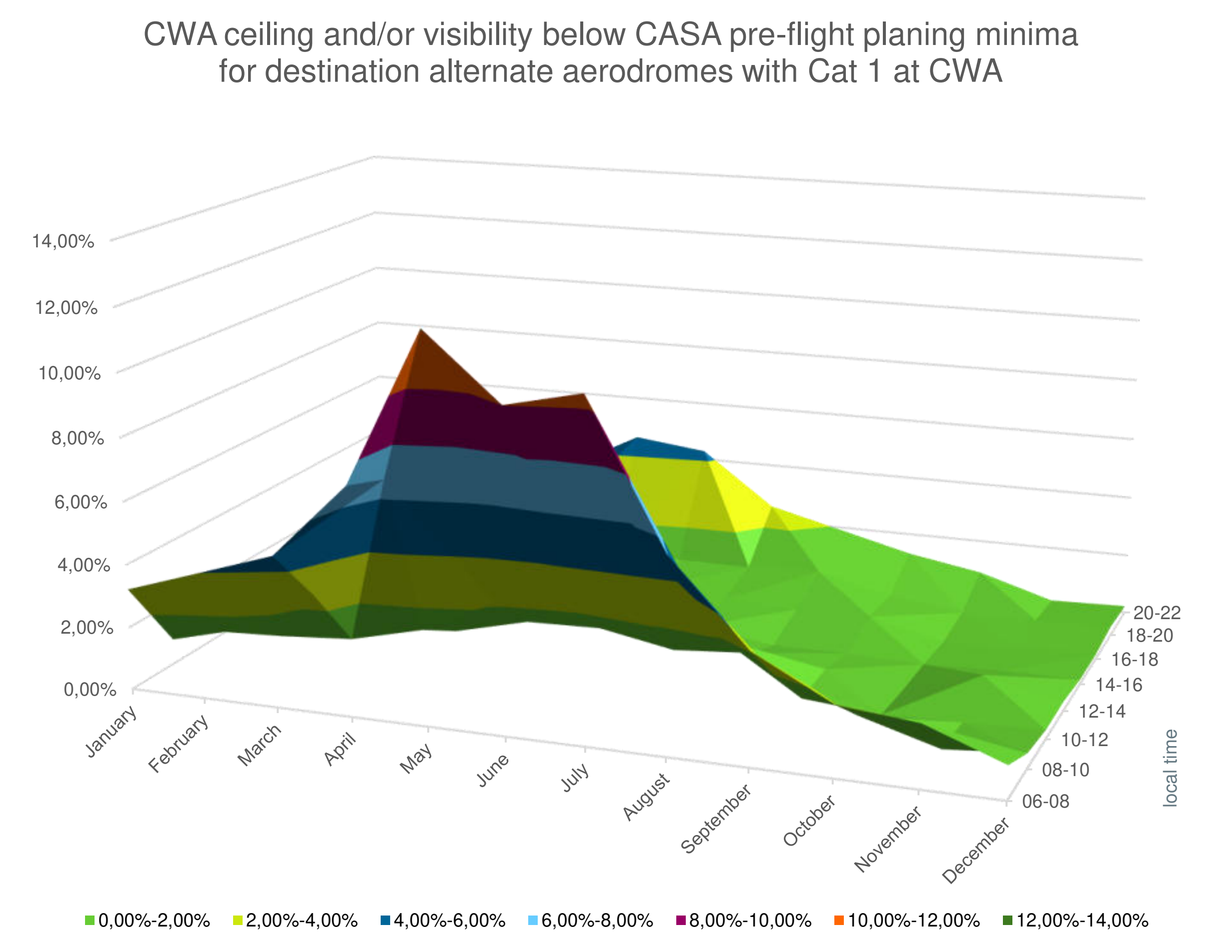


Figure 17 Probabilities for ceiling and/or visibility at CWA below CASA pre-flight planning minima for destination alternate aerodromes, statistically derived from data over the past 20 years. Assumption: ILS Cat 1 approach at CWA.[40]

[40] Reference: Munich Airport International GmbH, 2024

7.4.4.2 CASA pre-flight minima Cat 3 at CWA

Although, CWA indicated that there is currently no airline traffic from Australia to CPT, the following information on applicable Australian CASA pre-flight planning minima requirements is added for completeness, as there used to be flights from Australia to CPT in the past.

The following results are applicable to CASA pre-flight planning and consider an ILS Cat 3 approach as the best instrument approach at CWA. In this case, the probability of weather events preventing the planning of CWA as a destination alternate averages 4.45% of the year over the last 20 years. In contrast to an ILS Cat 1 approach at CWA (compare to 5.35%), the introduction of an ILS Cat 3 approach leads to 0.90% more availability as destination alternate aerodrome, considering CASA pre-flight minima requirements only. The statistical probability of events in which the weather in CWA is below the CASA pre-flight planning minima varies significantly over the course of the day and year.
As can be assumed, the probability of weather events below the CASA pre-flight planning minima is highest in the morning and evening hours during the winter months in Cape Town. The highest value is reached in May between 6-8 a.m. LT, during which time the probability of weather below CASA pre-flight planning minima, including consideration of airline operator requirements, is 12.90% (compare to 15.08% with Cat 1 only).
A closer look shows that the lowest probabilities are found in the morning hours of the summer months. This is due to the fact that the main determinants for weather events below the CASA pre-flight planning minima for CWA are low visibilities and low cloud bases in winter and strong winds in summer.
For detailed datasets please refer to Appendix 9.1.

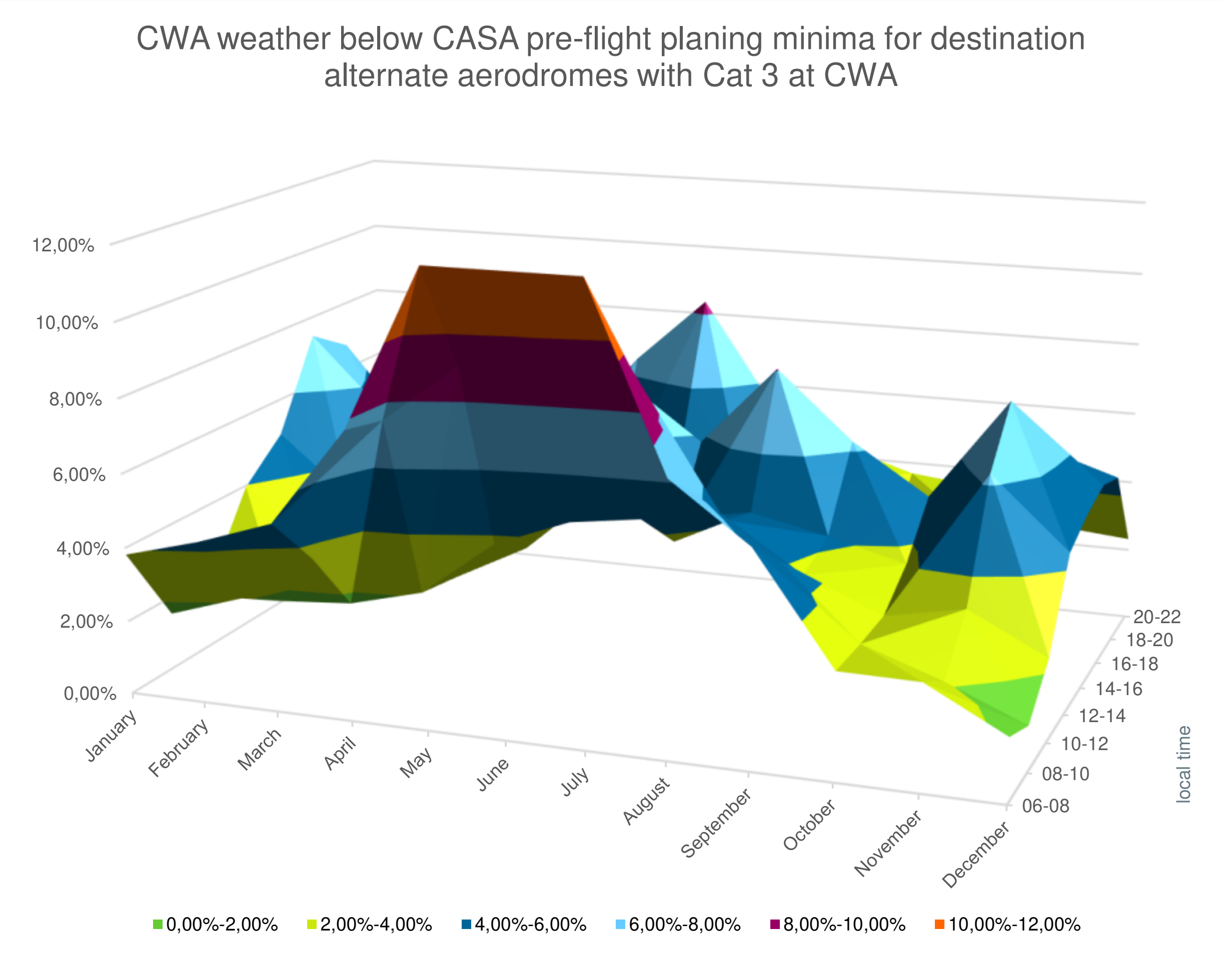


Figure 18 Probabilities for CWA weather below CASA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements, statistically derived from data over the past 20 years. Assumption: ILS Cat 3 approach at CWA.[41]

[41] Reference: Munich Airport International GmbH, 2024

As described above, visibilities and/or ceilings below the prescribed CASA pre-flight planning minima are the main determinants for winter weather events, which do not allow planning of CWA as a destination alternate aerodrome for CPT, as Figure 19 shows below.

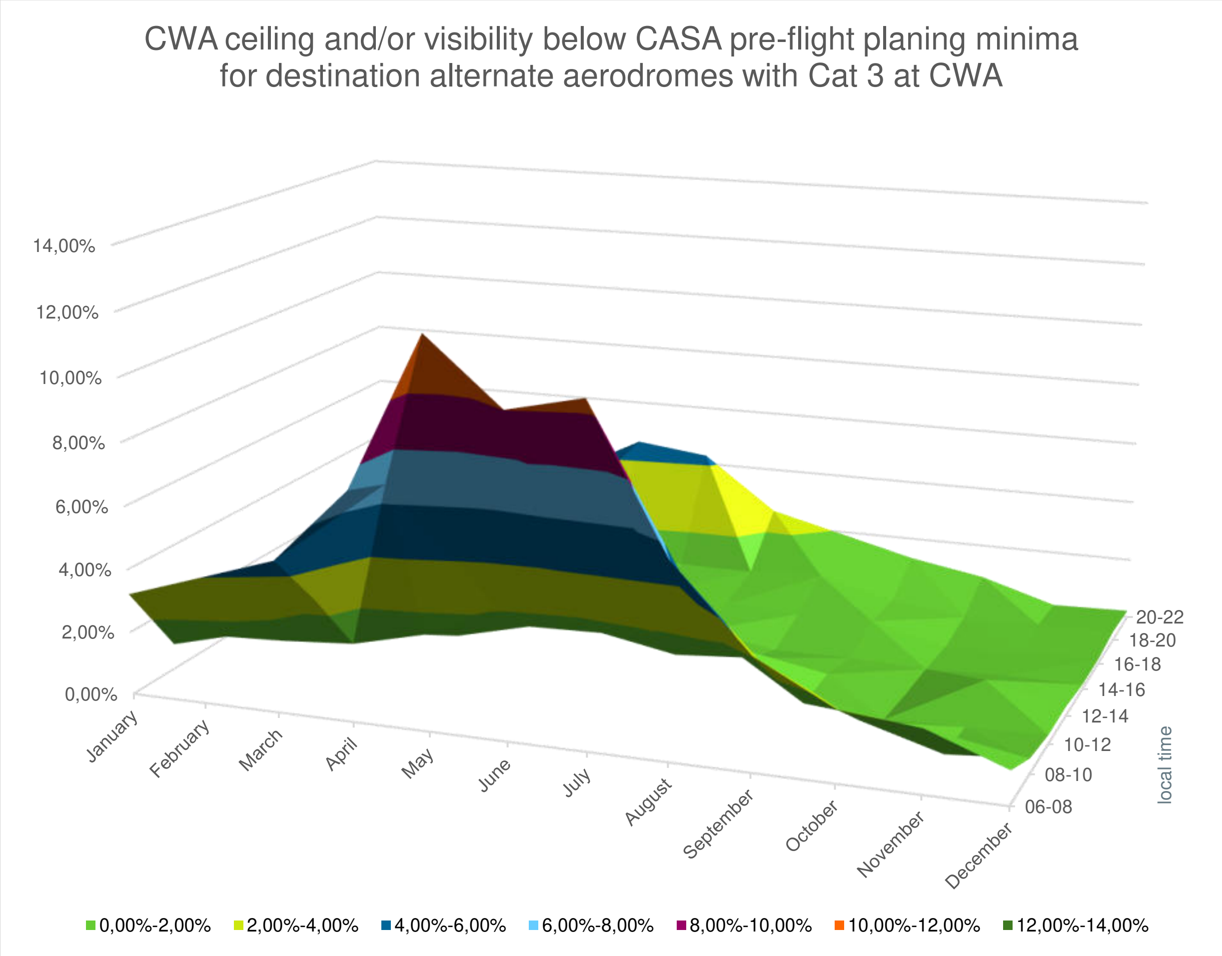


Figure 19 Probabilities for ceiling and/or visibility at CWA below CASA pre-flight planning minima for destination alternate aerodromes, statistically derived from data over the past 20 years. Assumption: ILS Cat 3 approach at CWA.[42]

[42] Reference: Munich Airport International GmbH, 2024

7.4.5 Results applicable to ICAO, EASA, FAA, and CASA pre-flight planning minima

The main determinant for weather events that do not allow CWA to be planned as destination alternate aerodrome during summer times manifests in wind limit exceedance events as shown in Figure 20 below. As outlined in chapter 7.3 Methodology, ICAO, EASA, FAA, and CASA based regulation on pre-flight planning minima for destination alternate aerodromes, require wind speeds to be within the certified aircraft limits. However, airline operator impose more restrictive wind limitation for pre-flight planning, which are considered in this case. Therefore, Figure 20 is valid for ICAO, EASA, FAA, and CASA regulation as considered in this weather analysis.

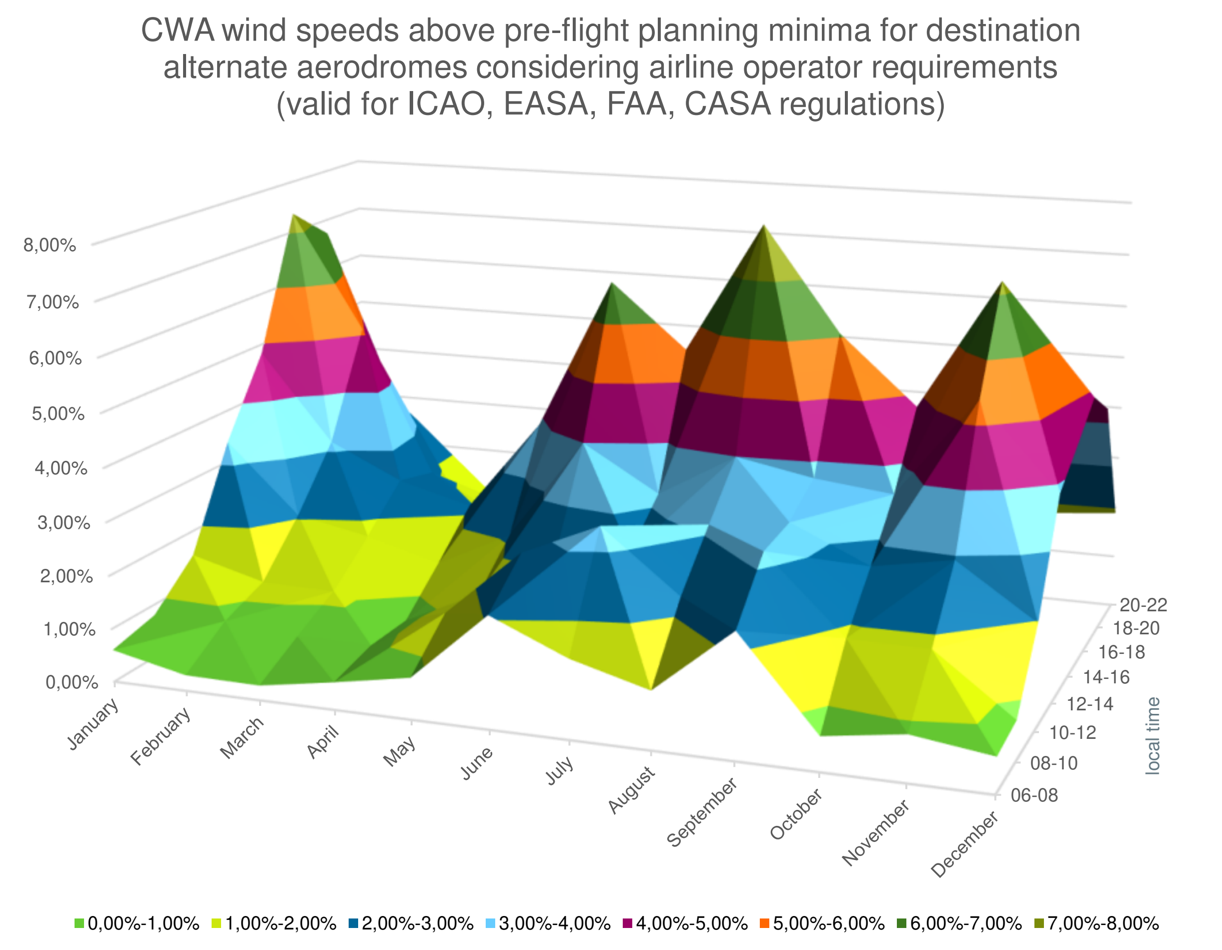


Figure 20 Probabilities for wind speeds at CWA above the pre-flight planning minima for destination alternate aerodromes considering airline operator requirements, statistically derived from data over the past 20 years. Since ICAO, EASA, FAA, and CASA regulations only require wind speeds to be within aircraft limits, airline operator requirements for pre-flight planning are more restrictive and limiting in this analysis. Therefore, this chart applies to ICAO, EASA; FAA and CASA pre-flight planning. [43]

[43] Reference: Munich Airport International GmbH, 2024

Weather threats, which include thunderstorms, heavy showers of precipitation, hail, and windshear, were analysed in this study in addition to low ceilings, low visibilities, and high wind speeds. Although, the consideration of weather threat events is not a legal requirement for destination alternate aerodromes as outlined in chapter 7.3 Methodology, airline operators usually impose additional requirements for pre-flight planning, which includes these phenomena. As can been seen in Figure 21, weather threat events play a negligible role when assessing the weather suitability of CWA as destination alternate aerodrome for CPT.

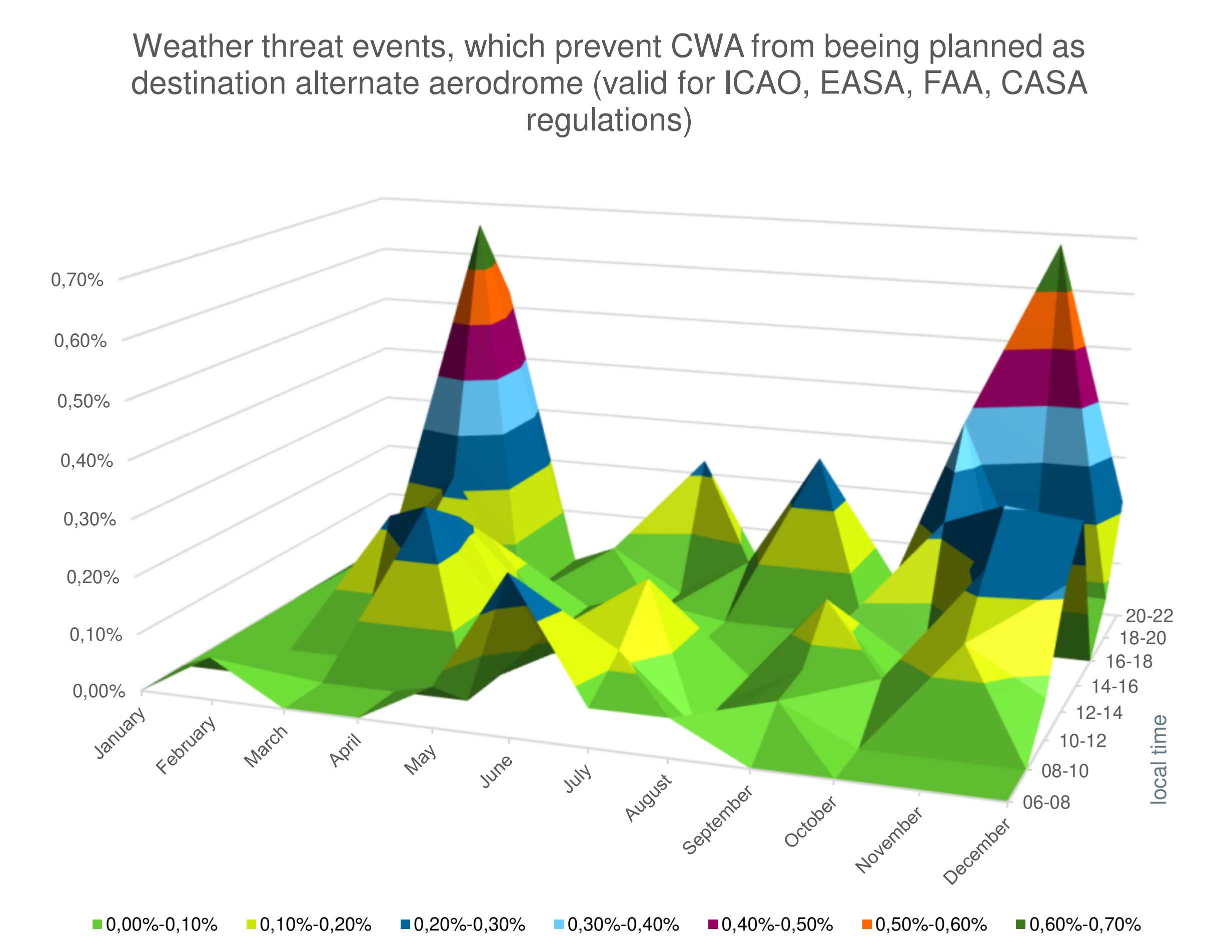


Figure 21 Probabilities for weather threat events which prevent CWA from being planned as destination alternate aerodrome, statistically derived from data over the past 20 years. Weather threats include: thunderstorms, heavy showers of precipitation, hail, and windshear. [44]

[44] Reference: Munich Airport International GmbH, 2024

7.5 Results for actual CPT timetable

While the previous chapters only considered the existence of one regulator for destination alternate aerodrome planning, the reality is characterized by different aircraft operators subject to different regulations. In order to obtain valid results from this weather analysis for the planning of CWA as a destination alternate, the applicable pre-flight planning minima for each airline must therefore be considered individually. To do this, MAI first investigated which long-haul airlines currently fly to CPT. MAI then examined which pre-flight planning minima requirements these airlines need to comply with in order to adapt the weather analysis to the applicable regulations together with their arrival times and thus obtain a realistic result. The table below shows the long-haul airlines flying to CPT, their respective applicable pre-flight planning minima and the arrival times.

Long-haul airline	Regulator	Applicable pre-flight planning minima	Arrival Periode
Condor (DE)	Luftfahrt Bundesamt	EASA	10-12
Lufthansa (LH)	Luftfahrt Bundesamt	EASA	6-8 10-12
Air France (AF)	Directorate General for Civil Aviation	EASA	20-22 (seasonal only)
Edelweiss Air (WK)	Bundesamt für Zivilluftfahrt	EASA	06-08
Qatar Airways (QR)	Qatar Civil Aviation Authority	EASA based[45]	10-12 16-18
British Airways (BA)	UK Civil Aviation Authority	ICAO based[46]	08-10 (LHR) 10-12 (LGW seasonal) 12-14 (LHR seasonal)
Virgin Atlantic (VS)	UK Civil Aviation Authority	ICAO based[47]	08-10 (seasonal)
Emirates (EK)	General Civil Aviation Authority UAE	ICAO based[48]	12-14 16-18
Turkish Airlines (TK)	General Directorate of Civil Aviation	ICAO based[49]	10-12
United Airlines (UA)	FAA	FAA	16-18

45 Qatar Civil Aviation Authority pre-flight planning minima are identical to EASA minima according to Acceptable Means of Compliance (AMCs) and Guidance Materials (GMs) to Annex IV – Part-CAT of Amendment 9 to QCAR 002/2016, AMC8 CAT.OP.MPA.182
46 According to UK Air Operations Regulation UK Reg (EU) 965/2012, Annex IV (Part-CAT), CAT.OP.MPA.185
47 According to UK Air Operations Regulation UK Reg (EU) 965/2012, Annex IV (Part-CAT), CAT.OP.MPA.185
48 According to GCAA UAE Civil Aviation Regulation Air Ops Part-CAT Issue 02 CAT.OP.MPA.185
49 According to UÇAKLA TĠCARĠ HAVA TAġIMA ĠġLETMECĠLĠĞĠ, OPERASYON USUL VE ESASLARI TALĠMATI (SHT OPS 1), Article 63 (available in Turkish only)

Delta Air Lines (DL)	FAA	FAA	16-18 (winter) 18-20 (summer)
KLM (KL)	Netherlands Civil Aviation Authority	EASA	20-22
Ethopian (ET)	Ethopian Civil Aviation Authority	FAA based[50i]	12-14 14-16

In order to adapt the weather analysis to the different pre-flight planning minima requirements, it was analysed which pre-flight planning minima have the largest share in the respective time increments, see table below. With the help of this data, the weather analysis was then adapted to consider different pre-flight planning minima requirements in different time periods.

Regulator Airline	Pre-flight minima considered for analysis							
	EASA	ICAO	EASA	ICAO	FAA	FAA	FAA	EASA
			ICAO TK					
			ICAO BA			FAA DL		
			EASA QR	FAA ET		FAA UA		
	EASA WK	ICAO VS	EASA LH	ICAO EK		ICAO EK		EASA KL
	EASA LH	ICAO BA	EASA DE	ICAO BA	FAA ET	EASA QR	FAA DL	EASA AF
Local time	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22

[50] According to Federal Democratic Republic of Ethopia, Civil Aviation Rules and Standards, Part 8 Operations, 8.6.2.11, 2019

7.5.1 Results for actual CPT timetable with ILS Cat 1 at CWA

The following results consider different pre-flight planning minima requirements according to the actual arrival times of airlines at CPT, as outlined in chapter 7.5 Results for actual CPT timetable, assuming an ILS Cat 1 approach as the best instrument approach at CWA. In this case, the probability of weather events preventing the planning of CWA as a destination alternate averages 4.34% of the year over the last 20 years. The statistical probability of events in which the weather in CWA is below the pre-flight planning minima varies significantly over the course of the day and year.

As can be assumed, the probability of weather events below the pre-flight planning minima is highest in the morning and evening hours during the winter months in Cape Town. The highest value is reached in May between 6-8 a.m. LT, during which time the probability of weather below pre-flight planning minima, including consideration of airline operator requirements, is 11.22%.

A closer look shows that the lowest probabilities are found in the morning hours of the summer months. This is due to the fact that the main determinants for weather events below the pre-flight planning minima for CWA are low visibilities and low cloud bases in winter and strong winds in summer.

For detailed datasets please refer to Appendix 9.1.

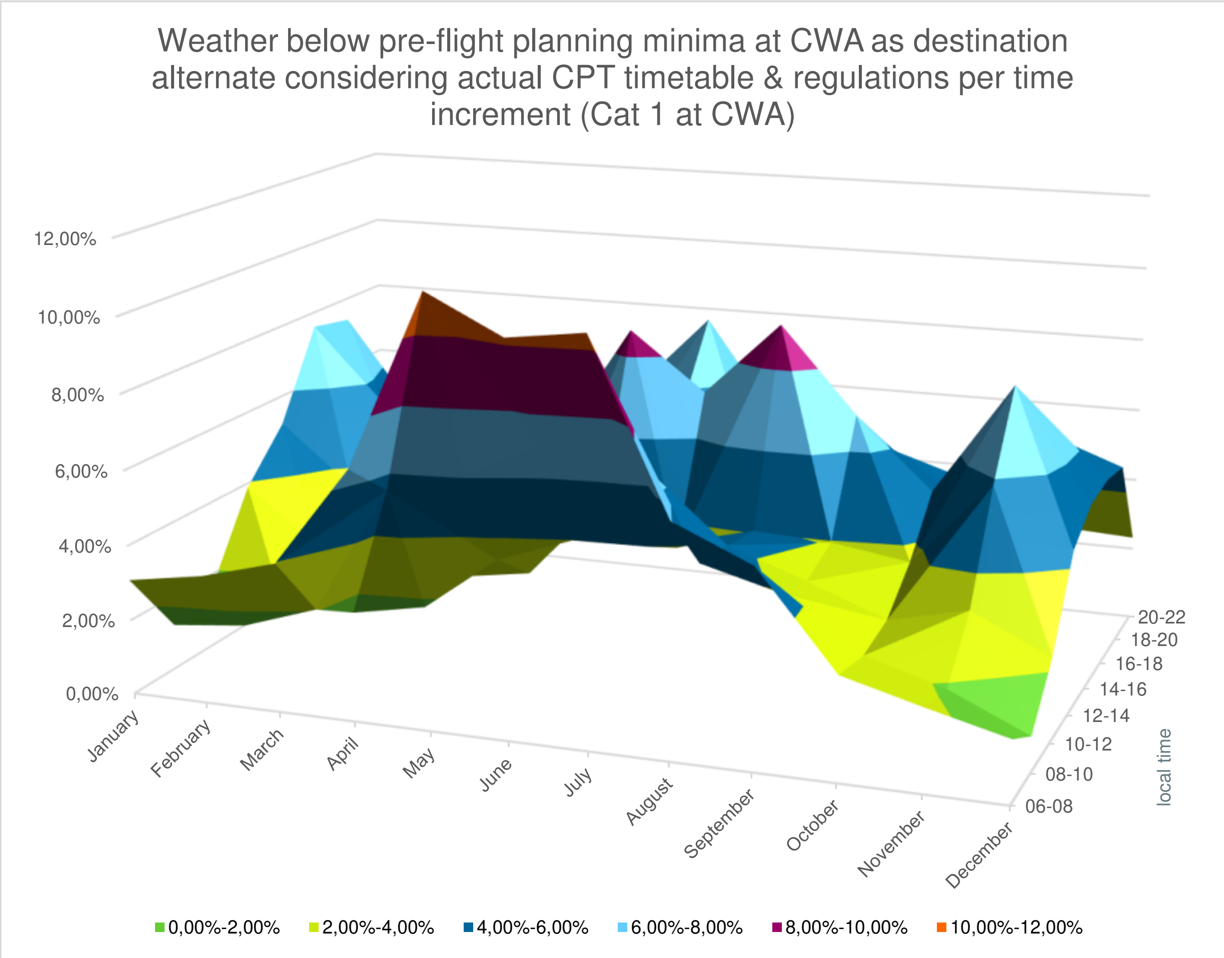


Figure 22 Probabilities for CWA weather below pre-flight planning minima for destination alternate aerodromes considering actual arrival times and the applicable pre-flight planning regulation requirements per aircraft operator per time increment, statistically derived from data over the past 20 years. Assumption: ILS Cat 1 approach at CWA. [51]

[51] Reference: Munich Airport International GmbH, 2024

7.5.2 Results for actual CPT timetable with ILS Cat 3 at CWA

The following results consider different pre-flight planning minima requirements according to the actual arrival times of airlines at CPT, as outlined in chapter 7.5 Results for actual CPT timetable, assuming an ILS Cat 3 approach as the best instrument approach at CWA. In this case, the probability of weather events preventing the planning of CWA as a destination alternate averages 4.27 % (compare to 4.34% with ILS Cat 1 approach at CWA) of the year over the last 20 years. The statistical probability of events in which the weather in CWA is below the pre-flight planning minima varies significantly over the course of the day and year.

As can be assumed, the probability of weather events below the pre-flight planning minima is highest in the morning and evening hours during the winter months in Cape Town. The highest value is reached in May between 6-8 a.m. LT, during which time the probability of weather below pre-flight planning minima, including consideration of airline operator requirements, is 11.22% (same value as with ILS Cat 1 approach, since arrivals at this time need to comply with EASA pre-flight planning minima, which do not differentiate between ILS Cat 1 or Cat 3 available.

A closer look shows that the lowest probabilities are found in the morning hours of the summer months. This is due to the fact that the main determinants for weather events below the pre-flight planning minima for CWA are low visibilities and low cloud bases in winter and strong winds in summer.

For detailed datasets please refer to Appendix 9.1.

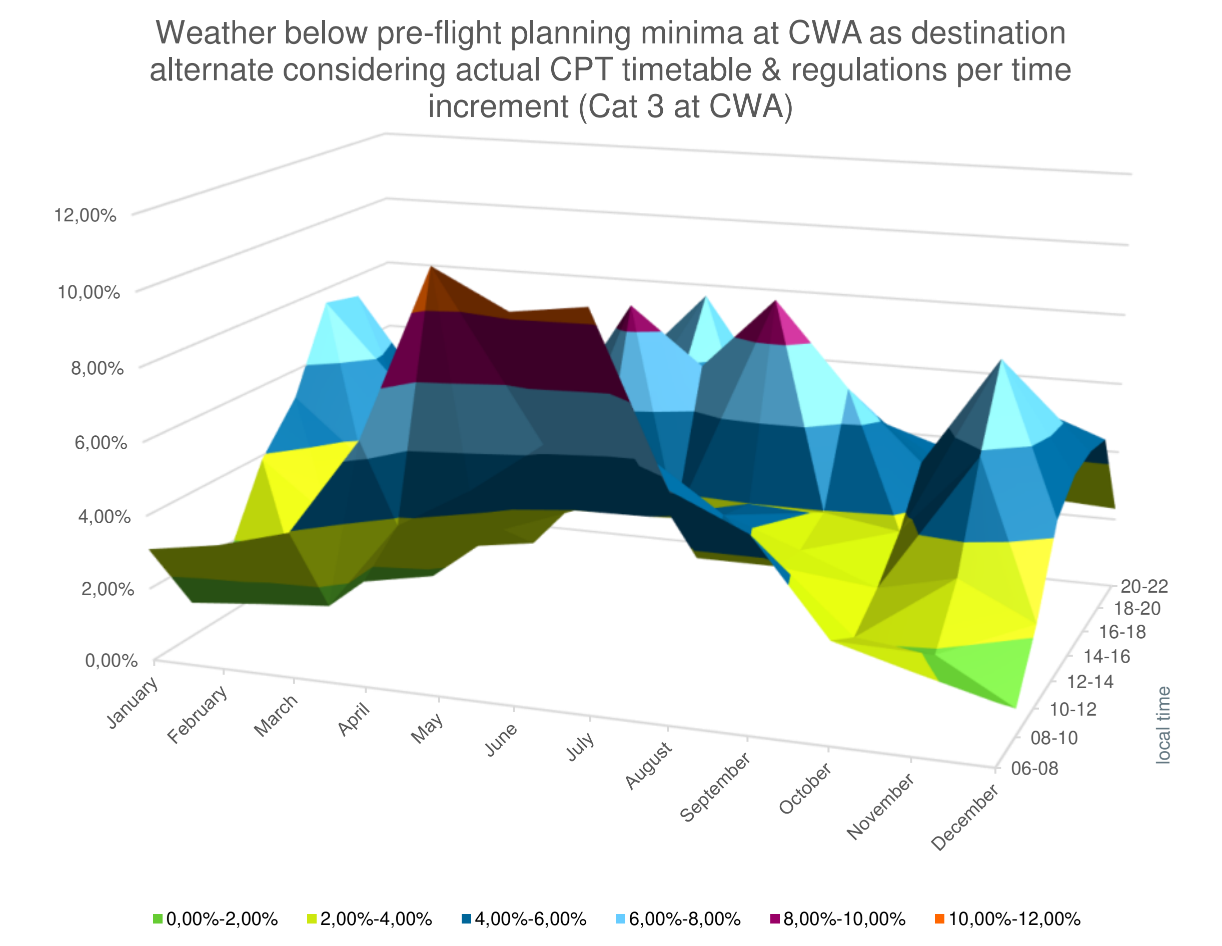


Figure 23 Probabilities for CWA weather below pre-flight planning minima for destination alternate aerodromes considering actual arrival times and the applicable pre-flight planning regulation requirements per aircraft operator per time increment, statistically derived from data over the past 20 years. Assumption: ILS Cat 3 approach at CWA. [52]

[52] Reference: Munich Airport International GmbH, 2024

7.6 Conclusion

Within this weather analysis, MAI has analysed the suitability of CWA as a destination alternate aerodrome for CPT on the basis of weather data from CPT over the last 20 years. At first, it was shown that the applicable pre-flight planning minima for CWA as a destination alternate depend on the respective regulation of the aircraft operator. For CWA, a distinction can be made between EASA, FAA, CASA, and ICAO based pre-flight planning minima when considering the long-haul flights arriving at CPT. Depending on the aerodrome approach capability at CWA, this results in different pre-flight planning minima, which lead to different times per year when the weather in CWA is below these pre-flight planning minima, which means that CWA cannot be specified a destination alternate, as shown in Figure 24.

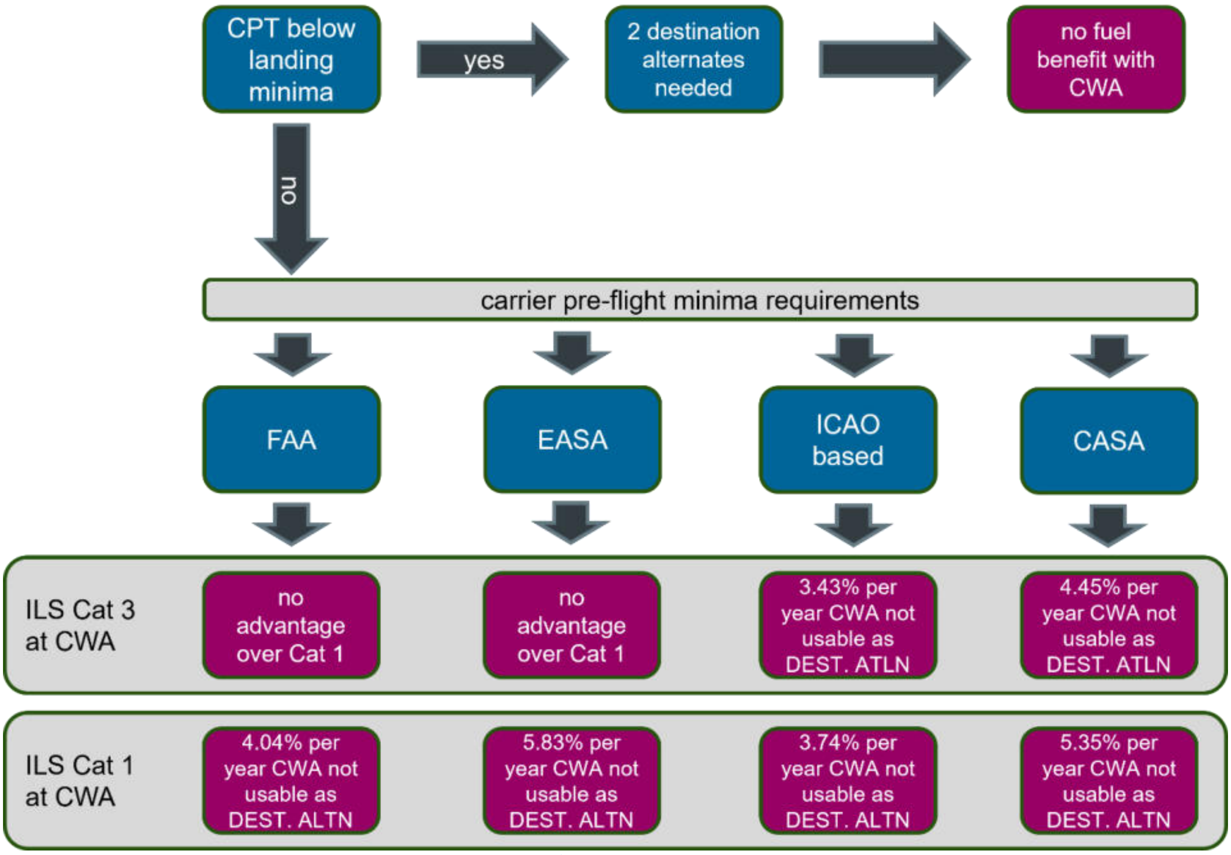


Figure 24 Conclusion of weather analysis for CWA.[53]

[53] Reference: Munich Airport International GmbH, 2024

Considering the different applicable pre-flight planning minima per airline and their arrival time in CPT, the weather analysis was adjusted accordingly, whereby two cases were examined: ILS Cat 1 and ILS Cat 3 approach available at CWA.
The key results of this weather analysis are outlined below:

- Assuming the availability of an ILS Cat 1 approach at CWA, the probability of weather events preventing the planning of CWA as a destination alternate averages **4.34%** per year, considering the actual CPT timetable.
- Assuming the availability of an ILS Cat 3 approach at CWA, the probability of weather events preventing the planning of CWA as a destination alternate averages **4.27%** per year considering the actual CPT timetable.
- The numbers above lead to the recommendation of MAI, that the establishment of an ILS Cat 1 approach at CWA is sufficient for the intended use as destination alternate aerodrome to CPT. There is no need to plan for an ILS Cat 3 approach system, which both has significant higher capital and operational expenditures.
- The results of the weather analysis indicate that CWA is very well suited to serve as a destination alternate. Regarding the weather situation, it is expected that CWA can be planned as the destination alternate aerodrome for CPT during **95,66%** of the annual operating time. Compared to other destination alternate aerodromes over the world, this is a remarkably high availability.

8 Special Operational Procedures for CWA as Alternate

The following chapter outlines some of the most important macro processes that are required in a diversion scenario in CWA. In addition to the high-level process description at process mapping level L1 (macro processes), technical and functional requirements as well as roles and responsibilities are shown.
Due to the limited project scope, only a limited number of macro processes can be described in this chapter. However, as the planning of CWA airport progresses, it will be important to develop a detailed CONOPS at an early stage that specifies the scheduled operation and general aviation processes as well as the processes in a diversion scenario and in emergency cases. This should not only show the macro processes, but also the underlying process levels from which subsequent SOPs can be derived.

8.1 Indicative Turnaround Process Description for Long-haul Aircraft

Figure 25 below shows the macro processes for a diverted long-haul aircraft that completes the flight at CWA and is prepared for the flight back according to the flight plan. Example: Flight from FRA to CPT diverted to CWA. Passengers disembark at CWA and aircraft is prepared for the flight back to FRA.

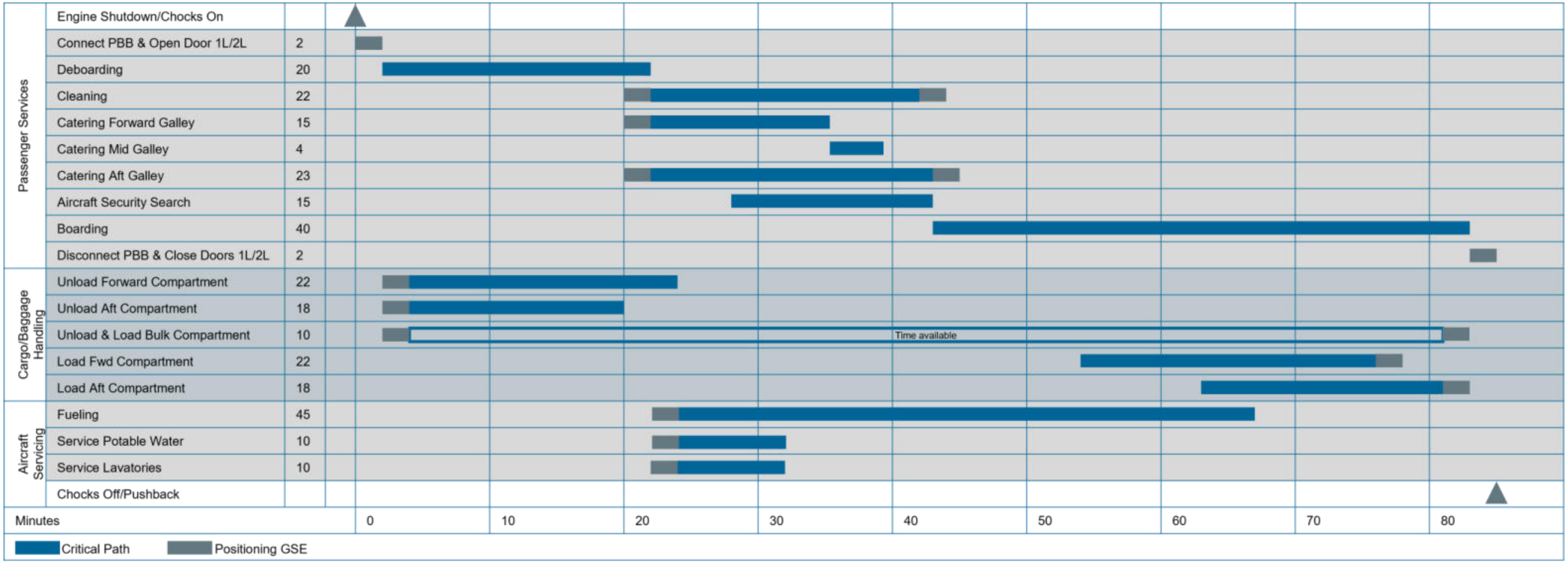
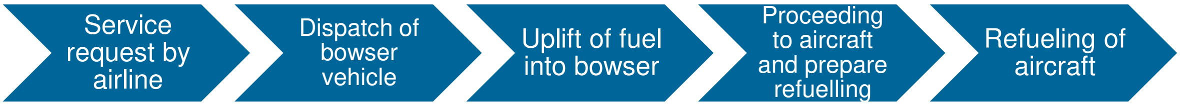


Figure 25 Indicative turnaround process for a long-haul aircraft at CWA, assuming a typical turnaround time of 85 minutes.[54]

[54] Reference: Munich Airport International GmbH 2024 based on Boeing 787 Airplane Characteristics for Airport Planning and typical process times from various airlines

8.2 Refuelling Process



The fuelling operation is typically an outsourced service. As fuelling can be a highly profitable business, the involvement of the airport operator may be discussed as part of a joint venture partner or similar. In some cases, the airport operator operates the fuel farm, but the into-plane (ITP) delivery is performed by a 3rd party.

Service request by airline

- The aircraft fuelling process is based on the service request by the airline. In most cases, the airline has a contractual agreement with the service provider to provide fuelling services for each departure.
- In a sufficient timespan before departure, the airline through their operations control centre or the air crew (typically via an internet platform) informs the fuelling service provider about the required amount of fuel, the block fuel.

Dispatch of bowser or hydrant vehicle

- Based on the required block fuel, the bowser or hydrant vehicle will be dispatched accordingly.
- The hydrant system is typically installed at all parking positions that are used on a regular basis. Therefore, hydrant vehicles shall be dispatched to those positions, while all other parking positions are supplied by bowsers. As the airport master plan for CWA states, it is still due to decide whether a hydrant system should be installed or not. For a final decision, MAI recommends conducting a feasibility study assessing advantages and disadvantages for such an installation at CWA.
- The dispatch can be performed with support of a resource management software and can be automated to high degree.

Uplift of fuel into bowser

- Bowser vehicle driver have to uplift fuel at the fuel farm.
- The location of the fuel farm is an important variable, because this impacts the time period required to proceed to the parked aeroplane. As the fuel farm is strategically located close to the apron at CWA, processing times will be rather short.
- In case of a hydrant system, the fuel farm location is secondary as fuel is always supplied through a pipeline system.

Proceeding to aircraft and prepare refuelling

- The vehicle driver proceeds timely to the aeroplane.

- The time of uplift is dependent on the aircraft size. In particular for long-haul flights, fuelling typically takes around 45 minutes and shall be planned timely.
- Typically, long-haul flights are refuelled twice, initially with approx. block fuel minus 1 ton per operational flight plan. Once the cockpit crew has agreed on the final fuel required for the flight, the final uplift will be done.
- Once the vehicle has arrived at the parking position, the driver prepares for refuelling. This includes the correct positioning of the aircraft to allow for escape route, grounding the vehicle and connecting the pipe between bowser and aeroplane or hydrant system, vehicle and aeroplane. It is important to check if passengers are on-board, deboarding or boarding.
- In any case with passengers on board, the flight crew needs to be informed before refuelling the aircraft. Refuelling with passengers on-board is an airline specific procedure. From an airport operator perspective, it must be ensured that emergency and fire vehicles are available at the aeroplane within 180 seconds in case of any emergency.
- In general, refuelling with passengers on-board shall be possible for smooth turnaround operation.

Refuelling of aircraft

- When the vehicle is positioned correctly and the aeroplane is ready for refuelling, the driver starts refuelling of the aeroplane.
- The driver is informed about the block fuel based on the request and displayed in the information and communication system.
- Most modern airliners have a preselection capability, which means that the cockpit crew preselects the required block fuel and the uplift automatically stops when the block fuel is reached.
- Once the service is completed, the driver disconnects everything and proceeds to the next service request or to the fuel farm for refuelling of the vehicle.

Technical and Functional Requirements

- Sufficient hydrant vehicles to service aeroplanes positioned at respective parking positions (if decided to install at CWA),
- Sufficient bowser vehicles to service aeroplanes at other parking stands and in case of not operational hydrant system,
- Fuel farm for aviation fuel
- Hydrant (underfloor fuelling) system at the apron (if decided to install at CWA),
- Fuel operator administration building,
- Sufficient space for fuelling vehicle parking.

Roles and Responsibilities

Stakeholder	Role	Responsibility
Fuelling Operator	Service Provider	Provide safe fuelling services to aeroplanes
Air Operator	Fuelling customer	Inform the fuelling operator about the required amount of fuel in a timely manner
CWA	Airport operator	Supervise and control the fuelling operator to ensure continuous availability of fuel and fuelling service.
Emergency Services	Emergency response provider	Provision of necessary equipment to deal with any refuelling emergencies (e.g. spillage, leakage).

8.3 Customs Process

- South African Revenue Service (Customs) specifies required declarations, credentials and supporting documentation to be filed, which are either an online declaration form or a manual traveller card, also known as a TC01 form, which needs to be completed prior arrival.
- Off-loaded checked baggage at CWA is customs-screened and tagged (red, green).
- Following authentication of arriving passenger and match with green-tagged bag.
- Else, passenger is requested for appointment with South Africa Revenue Service (Customs) on-airport with the reconciled baggage, in order to proceed with additional evidence as required.

Technical and Functional Requirements

- Technical specifications related to the current and emerging state immigration regimes e.g. for the EU the “Entry-Exit-System (EES) for EU originating / terminating passengers”, the USA “DHS regulations and special rules such as TSA-Pre ®”, visa management systems for states of relevance for air services serving CWA
- Customs clearance checkpoints (to be suitably / invisibly established minimizing impact), for baggage detected by inbound screening and marked to require on-site inspection (with physical presence of tag named holder) before being released

Roles and Responsibilities

Stakeholder	Role	Responsibility
South Africa Revenue Services (Customs)	Process owner	▪ Inspect credentials ▪ Inspect baggage ▪ Deliver customs clearance
Air Operator	Information sharing	▪ Passenger data ▪ Flight data ▪ Baggage data
Passenger		▪ File declarations ▪ Submit credentials ▪ Presence at customs inspection touchpoint
Baggage forwarder	Logistics services provider	▪ Accept baggage at CWA from ground handler ▪ Deliver baggage to passenger’s destination ▪ Manage inbound baggage supply chain

8.4 Immigration Process

- Entry applications are filed remotely by passengers in advance of their journey. Visa requirements vary with different countries of origin.
- Immigration authority approves successful submission of complete evidence information required and processes the credentials e.g. standard immigration form, Visas, other such as work permits etc.
- Immigration authority performs authentication and verification against applicable databases e.g. Interpol, Europol (for EU citizens), and South African registers and provides entry clearance to South Africa.

Technical and Functional Requirements

- CCTV with facial recognition capabilities for authentication of deboarded passengers and identification of passengers.
- Immigration kiosks for conducting staffed inspection of passengers, incl. a back-up solution,
- Deployment of supporting installations to enable connection to South African Entry-Exit-System,
- Interfaces for access to large-scale Travel Information and Authorization IT Systems,
- Readers for biometrics enabled machine readable travel documents,
- Zones in the vicinity to disembarkation gates suitable to establish a demarcated area into which passengers may be guided for spot-checks by authorities.

Roles and Responsibilities

Stakeholder	Role	Responsibility
South Africa Department Home Affairs	Process owner	▪ Define regulatory requirements applicable ▪ Deploy authority staff in CWA passenger building ▪ Provide IT systems and hardware for immigration processes
CWA	Airport operator	▪ Provide sufficient space, installations, utilities ▪ Manage technical / ICT, contractual and commercial arrangements with South Africa Department Home Affairs
Air Operator	Carrier of passenger and baggage	▪ Check passenger credentials (outbound airport) ▪ Perform air services into CWA ▪ Facilitate process, inform arriving passengers ▪ Collaborate with CWA and South Africa Department Home Affairs

Passenger		▪ Perform obligations related to South Africa entry ▪ Provide consents for personal data processing ▪ Undertake authentication upon arrival ▪ Undergo additional checks at immigration booth as required per authority requests

8.5 Security Process

The key objectives for the security screening process at CWA are zero breaches or prohibited items in the Security Restricted Area (SRA), smooth customer transition through the terminal, carrying out discrete, non-invasive security screening operations. The SRA according to the airport master plan are all parts of the 3rd security layer, including airside, apron, passenger arrival areas and general aviation areas.

Customer, Staff, Cabin bags

- All items crossing the security boundary into the SRA must be security screened. Implementation of a centralized security screening area is perceived to be the optimum solution in modern terminal buildings to create a single boundary line and manage all ‘passenger’ screening operations in one location, prior to them entering the retail areas.
- Dividing the SRA into Layer 3A being the airside and Layer 3B for the general aviation area, two ore more centralized security screening areas are required.

Hold Baggage, Goods and Cargo

- All hold baggage, goods and cargo intended to be placed on an aircraft must be security screened before entering the SRA. Current regulations require that the first level of assessment must be through automatic machine evaluation of the bag using standard 3 ECAC compliant EDS xrays. The level 1 xray image of any bag that alarms if viewed by an operator at level 2. If the operator deems it an immediate threat, the bag is sent to level 5 (threat containment unit). Otherwise, for any other potential prohibited items the operator requests a level 3 review where the item is rescreened. In the event of the need to remove an item from the bag, it is diverted to level 4 and opened by an operator.
- For level 4 procedure, to minimize disruption to the passenger, it is advised to follow the principle of TSA and insert a document in the bag stating that an item has been removed. This also reduces delays whilst trying to locate the owner.
- In the event of a confirmed threat – the name information from the bag tag shall be used to locate the person.
- All hold baggage, goods and cargo screening should take place at a dedicated, centralized consolidation warehouse near the terminal building.

Technical and Functional Requirements

- Security xrays are required to carry out security screening, which could either be dual view systems, that show two views of scanned items, horizontally from the side and diagonally from below or more advanced Computed Tomography (CT), which offers 2D & 3D images with easy rotation and image slices to allow for a lower false alarm rate. CT systems are mandated by the EU for hold baggage screening.
- Xray image review staff shall be located in a remote room to carry out their task. This not only removes distractions at the screening checkpoint, it also allows for streamlined resourcing as they can view images from any screening lane.
- Supporting equipment includes walkthrough metal detectors (WTMD), Body scanners, handheld metal detectors (HHMD) and portable liquid explosive detection (LEDs).

Roles and Responsibilities

As roles and responsibilities for security screening at airports vary widely with different national regulations and governmental agreements, a dedicated study should be conducted to analyse the roles and responsibilities of security screening processes at CWA. In particular, it should be analysed who provides the security control service, who monitors it and by whom it is commissioned.

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9 Appendix

9.1 Weather Analysis Datasets

9.1.1 ICAO pre-flight planning minima with Cat 1 at CWA weather analysis datasets

CWA weather below ICAO pre-flight planning minima for destination alternate aerodromes with Cat 1 at CWA including consideration of further airline operator requirements:

This table shows the probability for every time increment for the weather to be below the applicable ICAO pre-flight planning minima for CWA as destination alternate aerodrome with only a CAT 1 ILS approach available and includes further airline operator requirements as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	2,41%	1,20%	1,60%	3,89%	4,98%	7,43%	6,71%	2,04%	2,41%	**3,78%**
February	2,52%	1,41%	1,31%	2,37%	3,31%	5,36%	3,82%	1,84%	2,11%	**2,74%**
March	3,19%	2,08%	1,20%	2,30%	2,65%	2,58%	1,82%	2,05%	2,52%	**2,23%**
April	5,35%	5,49%	1,51%	1,94%	2,36%	1,67%	2,11%	2,49%	3,82%	**2,87%**
May	9,26%	6,07%	3,11%	2,25%	3,95%	2,18%	1,44%	4,65%	8,07%	**4,11%**
June	8,43%	7,01%	3,23%	4,44%	6,88%	4,04%	3,56%	6,40%	9,17%	**5,50%**
July	8,30%	7,30%	3,69%	3,39%	5,55%	2,56%	1,72%	4,45%	7,33%	**4,62%**
August	5,21%	4,41%	4,07%	4,07%	8,05%	5,32%	3,79%	3,54%	5,34%	**4,81%**
September	4,71%	3,87%	3,54%	3,96%	6,22%	2,87%	2,13%	2,69%	3,20%	**3,75%**
October	2,53%	2,50%	2,75%	3,64%	4,89%	3,69%	2,85%	2,80%	2,59%	**3,21%**
November	1,77%	1,90%	3,23%	5,88%	7,52%	5,98%	4,02%	2,43%	2,82%	**4,09%**
December	1,38%	0,95%	2,11%	4,37%	4,79%	5,03%	4,54%	2,25%	2,29%	**3,18%**
Average	**4,59%**	**3,68%**	**2,61%**	**3,54%**	**5,10%**	**4,06%**	**3,21%**	**3,14%**	4,31%	**3,74%**

Figure 26 CWA weather below ICAO pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements with Cat 1 ILS approach at CWA.

CWA ceiling and/or visibility below ICAO pre-flight planning minima for destination alternate aerodromes with Cat 1 at CWA

This table shows the probability for every time increment for the weather to be below the applicable requirements for ceiling and/or visibility according to the ICAO pre-flight planning minima for CWA as destination alternate aerodrome with only a Cat 1 approach at CWA as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	1,81%	0,47%	0,07%	0,50%	0,15%	0,07%	0,07%	0,00%	0,91%	**0,39%**
February	2,15%	0,57%	0,15%	0,32%	0,16%	0,16%	0,48%	0,72%	1,53%	**0,59%**
March	2,91%	1,37%	0,07%	0,30%	0,00%	0,08%	0,00%	0,45%	1,48%	**0,65%**
April	4,84%	4,78%	0,50%	0,31%	0,08%	0,16%	0,94%	1,87%	3,31%	**1,69%**
May	8,42%	4,64%	1,73%	0,15%	0,07%	0,15%	0,15%	2,76%	7,39%	**2,26%**
June	6,22%	4,38%	1,10%	0,44%	0,15%	0,31%	0,30%	2,33%	6,68%	**1,90%**
July	6,77%	3,98%	1,07%	0,22%	0,07%	0,08%	0,30%	1,63%	6,08%	**1,77%**
August	4,08%	2,15%	0,94%	0,07%	0,07%	0,07%	0,86%	1,13%	3,56%	**1,17%**
September	2,42%	0,58%	0,14%	0,08%	0,08%	0,08%	0,23%	0,23%	1,14%	**0,48%**
October	1,89%	0,66%	0,00%	0,07%	0,08%	0,00%	0,00%	0,22%	1,48%	**0,37%**
November	0,92%	0,07%	0,15%	0,23%	0,00%	0,00%	0,00%	0,00%	0,99%	**0,17%**
December	0,72%	0,20%	0,14%	0,29%	0,15%	0,15%	0,14%	0,14%	0,93%	**0,24%**
Average	**3,60%**	**1,99%**	**0,51%**	**0,25%**	**0,09%**	**0,11%**	**0,29%**	**0,96%**	2,96%	**0,97%**

Figure 27 CWA ceiling and/or visibility below ICAO pre-flight planning minima for destination alternate aerodromes with Cat 1 ILS approach at CWA

9.1.2 ICAO pre-flight planning minima with Cat 3 at CWA weather analysis datasets

CWA weather below ICAO pre-flight planning minima for destination alternate aerodromes with Cat 3 at CWA including consideration of further airline operator requirements:

This table shows the probability for every time increment for the weather to be below the applicable ICAO pre-flight planning minima for CWA as destination alternate aerodrome with only a Cat 3 ILS approach available and includes further airline operator requirements as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	1,47%	0,93%	1,60%	3,89%	4,98%	7,43%	6,71%	2,04%	1,83%	**3,63%**
February	1,18%	1,13%	1,31%	2,37%	3,31%	5,36%	3,50%	1,28%	1,23%	**2,43%**
March	1,39%	1,30%	1,20%	2,30%	2,65%	2,58%	1,82%	1,67%	1,89%	**1,86%**
April	4,03%	3,75%	1,15%	1,94%	2,36%	1,67%	1,64%	1,48%	2,77%	**2,25%**
May	7,50%	4,89%	2,28%	2,25%	3,95%	2,18%	1,44%	3,78%	6,37%	**3,53%**
June	7,11%	6,32%	2,96%	4,37%	6,80%	3,97%	3,33%	5,42%	7,81%	**5,03%**
July	6,91%	6,77%	3,22%	3,39%	5,55%	2,56%	1,42%	3,64%	6,12%	**4,18%**
August	4,28%	3,74%	3,67%	4,00%	8,05%	5,25%	3,51%	3,47%	4,47%	**4,50%**
September	3,90%	3,74%	3,54%	3,96%	6,22%	2,87%	2,05%	2,61%	3,05%	**3,61%**
October	1,45%	2,11%	2,75%	3,64%	4,89%	3,69%	2,85%	2,58%	2,11%	**2,99%**
November	1,31%	1,90%	3,23%	5,88%	7,52%	5,98%	4,02%	2,43%	2,25%	**4,03%**
December	0,98%	0,75%	2,04%	4,37%	4,79%	5,03%	4,54%	2,25%	1,61%	**3,09%**
Average	**3,46%**	**3,11%**	**2,41%**	**3,53%**	**5,09%**	**4,05%**	**3,07%**	**2,72%**	3,46%	**3,43%**

Figure 28 CWA weather below ICAO pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements with Cat 3 ILS approach at CWA.

CWA ceiling and/or visibility below ICAO pre-flight planning minima for destination alternate aerodromes with Cat 3 at CWA

This table shows the probability for every time increment for the weather to be below the applicable requirements for ceiling and/or visibility according to the ICAO pre-flight planning minima for CWA as destination alternate aerodrome with only a Cat 3 approach at CWA as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	0,87%	0,20%	0,07%	0,50%	0,15%	0,07%	0,07%	0,00%	0,34%	**0,24%**
February	0,81%	0,28%	0,15%	0,32%	0,16%	0,16%	0,16%	0,16%	0,65%	**0,28%**
March	1,11%	0,59%	0,07%	0,30%	0,00%	0,08%	0,00%	0,08%	0,86%	**0,28%**
April	3,52%	3,04%	0,14%	0,31%	0,08%	0,16%	0,47%	0,86%	2,27%	**1,07%**
May	6,66%	3,47%	0,90%	0,15%	0,07%	0,15%	0,15%	1,89%	5,69%	**1,68%**
June	4,90%	3,63%	0,82%	0,37%	0,07%	0,23%	0,08%	1,35%	5,32%	**1,43%**
July	5,38%	3,38%	0,60%	0,22%	0,00%	0,08%	0,00%	0,82%	4,87%	**1,31%**
August	3,14%	1,47%	0,53%	0,00%	0,07%	0,00%	0,57%	1,06%	2,69%	**0,86%**
September	1,62%	0,45%	0,14%	0,08%	0,08%	0,08%	0,15%	0,15%	0,97%	**0,34%**
October	0,82%	0,26%	0,00%	0,07%	0,08%	0,00%	0,00%	0,00%	1,00%	**0,15%**
November	0,46%	0,07%	0,15%	0,23%	0,00%	0,00%	0,00%	0,00%	0,42%	**0,11%**
December	0,33%	0,00%	0,07%	0,29%	0,15%	0,15%	0,14%	0,14%	0,25%	**0,16%**
Average	**2,47%**	**1,40%**	**0,31%**	**0,24%**	**0,08%**	**0,10%**	**0,15%**	**0,54%**	2,11%	**0,66%**

Figure 29 CWA ceiling and/or visibility below ICAO pre-flight planning minima for destination alternate aerodromes with Cat 3 ILS approach at CWA

9.1.3 CASA pre-flight planning minima with Cat 1 at CWA weather analysis datasets

CWA weather below CASA pre-flight planning minima for destination alternate aerodromes with Cat 1 at CWA including consideration of further airline operator requirements:

This table shows the probability for every time increment for the weather to be below the applicable CASA pre-flight planning minima for CWA as destination alternate aerodrome with only a CAT 1 ILS approach available and includes further airline operator requirements as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	4,69%	2,47%	2,51%	4,39%	5,12%	7,58%	7,14%	3,05%	4,61%	**4,62%**
February	5,70%	2,97%	1,85%	2,37%	3,39%	5,52%	4,85%	3,29%	5,30%	**3,74%**
March	7,28%	4,95%	3,18%	2,82%	3,03%	3,11%	2,81%	3,79%	5,84%	**3,87%**
April	9,60%	9,11%	3,45%	2,64%	3,15%	2,46%	4,31%	6,00%	7,81%	**5,09%**
May	15,08%	11,08%	5,40%	4,13%	5,73%	3,90%	3,93%	8,87%	13,21%	**7,27%**
June	14,64%	11,20%	5,64%	5,70%	8,30%	5,34%	5,14%	9,33%	14,24%	**8,16%**
July	13,88%	11,63%	6,51%	4,94%	6,75%	3,61%	2,99%	6,46%	11,06%	**7,09%**
August	8,96%	7,70%	6,68%	6,38%	8,69%	6,13%	4,51%	4,89%	8,55%	**6,74%**
September	6,59%	5,87%	4,69%	4,72%	6,61%	4,52%	4,26%	4,23%	5,28%	**5,19%**
October	4,55%	3,43%	3,32%	3,87%	4,89%	3,99%	3,45%	4,35%	4,49%	**3,98%**
November	4,19%	2,95%	3,53%	6,42%	7,75%	6,45%	4,41%	2,96%	5,21%	**4,83%**
December	2,56%	1,91%	2,39%	4,45%	4,79%	5,11%	4,83%	2,75%	3,54%	**3,60%**
Average	**8,14%**	**6,27%**	**4,09%**	**4,40%**	**5,68%**	**4,81%**	**4,38%**	**5,00%**	7,43%	**5,35%**

Figure 30 CWA weather below CASA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements with Cat 1 ILS approach at CWA.

CWA ceiling and/or visibility below CASA pre-flight planning minima for destination alternate aerodromes with Cat 1 at CWA

This table shows the probability for every time increment for the weather to be below the applicable requirements for ceiling and/or visibility according to the CASA pre-flight planning minima for CWA as destination alternate aerodrome with only a Cat 1 approach at CWA as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	4,08%	1,73%	0,97%	1,08%	0,29%	0,22%	0,79%	1,02%	3,12%	**1,27%**
February	5,33%	2,33%	0,77%	0,32%	0,24%	0,32%	1,51%	2,16%	4,72%	**1,62%**
March	7,00%	4,23%	2,19%	0,89%	0,45%	0,61%	0,99%	2,20%	4,82%	**2,32%**
April	9,09%	8,60%	2,51%	1,01%	0,87%	0,95%	3,13%	5,38%	7,39%	**3,94%**
May	14,24%	9,66%	4,01%	2,03%	2,01%	1,88%	2,65%	6,98%	12,53%	**5,43%**
June	12,64%	8,70%	3,71%	1,93%	1,79%	1,68%	1,97%	5,42%	11,96%	**4,73%**
July	12,35%	8,61%	4,16%	1,99%	1,50%	1,20%	1,57%	3,71%	9,83%	**4,39%**
August	7,82%	5,55%	3,87%	2,52%	0,93%	1,31%	2,22%	2,62%	6,83%	**3,36%**
September	4,51%	3,03%	1,37%	1,29%	0,77%	1,81%	2,66%	2,08%	3,63%	**2,19%**
October	3,91%	1,58%	0,58%	0,30%	0,08%	0,30%	0,67%	1,85%	3,41%	**1,16%**
November	3,34%	1,12%	0,44%	1,01%	0,23%	0,62%	0,39%	0,68%	3,45%	**0,98%**
December	1,90%	1,16%	0,49%	0,51%	0,15%	0,22%	0,43%	0,65%	2,18%	**0,69%**
Average	**7,18%**	**4,69%**	**2,09%**	**1,24%**	**0,78%**	**0,93%**	**1,58%**	**2,90%**	6,16%	**2,67%**

Figure 31 CWA ceiling and/or visibility below CASA pre-flight planning minima for destination alternate aerodromes with Cat 1 ILS approach at CWA

9.1.4 CASA pre-flight planning minima with Cat 3 at CWA weather analysis datasets

CWA weather below CASA pre-flight planning minima for destination alternate aerodromes with Cat 3 at CWA including consideration of further airline operator requirements:

This table shows the probability for every time increment for the weather to be below the applicable CASA pre-flight planning minima for CWA as destination alternate aerodrome with a Cat 3 ILS approach available and includes further airline operator requirements as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	3,82%	1,53%	1,81%	3,96%	4,98%	7,43%	6,71%	2,47%	3,67%	**4,09%**
February	4,37%	2,19%	1,46%	2,37%	3,31%	5,44%	4,37%	2,48%	3,77%	**3,25%**
March	5,06%	3,52%	1,62%	2,37%	2,65%	2,66%	1,97%	2,88%	4,51%	**2,84%**
April	7,70%	7,43%	2,15%	1,94%	2,60%	1,90%	2,98%	3,98%	5,74%	**3,84%**
May	12,90%	9,04%	3,74%	3,01%	4,39%	2,85%	2,65%	6,47%	10,73%	**5,63%**
June	12,15%	9,51%	4,54%	4,81%	7,32%	4,58%	4,24%	8,35%	11,94%	**6,94%**
July	12,08%	9,91%	4,83%	3,61%	5,85%	3,08%	2,46%	5,35%	9,75%	**5,90%**
August	7,22%	6,23%	5,01%	4,63%	8,05%	5,54%	3,87%	4,32%	6,99%	**5,61%**
September	5,72%	4,77%	3,75%	4,19%	6,22%	3,32%	2,43%	3,69%	4,19%	**4,26%**
October	2,84%	2,83%	2,89%	3,64%	4,89%	3,69%	3,07%	3,47%	3,22%	**3,42%**
November	2,81%	2,11%	3,31%	6,26%	7,67%	6,06%	4,26%	2,51%	4,12%	**4,37%**
December	1,70%	1,23%	2,25%	4,37%	4,79%	5,03%	4,69%	2,32%	2,89%	**3,30%**
Average	**6,53%**	**5,03%**	**3,11%**	**3,76%**	**5,23%**	**4,30%**	**3,64%**	**4,02%**	5,96%	**4,45%**

Figure 32 CWA weather below CASA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements with Cat 3 ILS approach at CWA.

CWA ceiling and/or visibility below CASA pre-flight planning minima for destination alternate aerodromes with Cat 3 at CWA

This table shows the probability for every time increment for the weather to be below the applicable requirements for ceiling and/or visibility according to the CASA pre-flight planning minima for CWA as destination alternate aerodrome with a Cat 3 approach at CWA as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	3,21%	0,80%	0,28%	0,58%	0,15%	0,07%	0,07%	0,44%	2,17%	**0,70%**
February	4,00%	1,41%	0,39%	0,32%	0,16%	0,24%	1,03%	1,36%	3,19%	**1,11%**
March	4,79%	2,80%	0,56%	0,37%	0,00%	0,15%	0,15%	1,29%	3,50%	**1,26%**
April	7,18%	6,72%	1,15%	0,31%	0,32%	0,40%	1,80%	3,35%	5,26%	**2,65%**
May	12,06%	7,62%	2,35%	0,90%	0,60%	0,83%	1,36%	4,58%	10,05%	**3,79%**
June	10,01%	7,01%	2,47%	0,96%	0,60%	0,84%	1,06%	4,29%	9,53%	**3,41%**
July	10,56%	6,65%	2,21%	0,52%	0,52%	0,68%	1,04%	2,52%	8,50%	**3,09%**
August	6,08%	3,96%	1,94%	0,70%	0,14%	0,58%	1,15%	1,91%	5,21%	**2,06%**
September	3,50%	1,87%	0,36%	0,46%	0,15%	0,60%	0,53%	1,31%	2,34%	**1,10%**
October	2,21%	0,99%	0,14%	0,07%	0,08%	0,00%	0,22%	0,89%	2,11%	**0,58%**
November	1,96%	0,28%	0,22%	0,85%	0,15%	0,08%	0,23%	0,15%	2,33%	**0,49%**
December	1,05%	0,48%	0,28%	0,29%	0,15%	0,15%	0,29%	0,22%	1,53%	**0,36%**
Average	**5,55%**	**3,38%**	**1,03%**	**0,53%**	**0,25%**	**0,38%**	**0,75%**	**1,86%**	4,64%	**1,72%**

Figure 33 CWA ceiling and/or visibility below CASA pre-flight planning minima for destination alternate aerodromes with Cat 3 ILS approach at CWA

9.1.5 EASA pre-flight planning minima weather analysis datasets

CWA weather below EASA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements:

This table shows the probability for every time increment for the weather to be below the applicable EASA pre-flight planning minima for CWA as destination alternate aerodrome and includes further airline operator requirements as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	3,08%	1,27%	1,67%	3,89%	4,98%	7,43%	6,71%	2,33%	3,15%	**3,92%**
February	3,40%	1,56%	1,31%	2,37%	3,31%	5,36%	3,97%	2,16%	2,93%	**2,93%**
March	3,95%	2,80%	1,34%	2,30%	2,65%	2,58%	1,90%	2,35%	3,44%	**2,48%**
April	6,60%	6,27%	1,72%	1,94%	2,44%	1,67%	2,19%	3,04%	4,64%	**3,23%**
May	11,22%	7,68%	3,25%	2,33%	4,02%	2,55%	1,74%	5,60%	9,50%	**4,80%**
June	10,22%	8,07%	3,99%	4,59%	6,88%	4,27%	3,93%	7,67%	10,57%	**6,20%**
July	10,49%	8,49%	4,02%	3,39%	5,55%	2,56%	2,01%	4,90%	8,36%	**5,18%**
August	6,08%	4,98%	4,28%	4,14%	8,05%	5,40%	3,79%	4,04%	6,16%	**5,09%**
September	5,18%	4,00%	3,54%	4,11%	6,22%	2,87%	2,13%	2,92%	3,58%	**3,87%**
October	2,71%	2,57%	2,75%	3,64%	4,89%	3,69%	3,00%	3,39%	3,01%	**3,33%**
November	2,16%	2,11%	3,23%	5,88%	7,67%	5,98%	4,02%	2,43%	3,66%	**4,19%**
December	1,64%	1,02%	2,25%	4,37%	4,79%	5,03%	4,54%	2,32%	2,56%	**3,25%**
Average	**5,56%**	**4,23%**	**2,78%**	**3,58%**	**5,12%**	**4,12%**	**3,33%**	**3,60%**	5,13%	**4,04%**

Figure 34 CWA weather below EASA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements

CWA ceiling and/or visibility below EASA pre-flight planning minima for destination alternate aerodromes

This table shows the probability for every time increment for the weather to be below the applicable requirements for ceiling and/or visibility according to the EASA pre-flight planning minima for CWA as destination alternate aerodrome as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	2,48%	0,53%	0,14%	0,50%	0,15%	0,07%	0,07%	0,29%	1,66%	**0,53%**
February	3,03%	0,71%	0,15%	0,32%	0,16%	0,16%	0,64%	1,04%	2,35%	**0,78%**
March	3,68%	2,08%	0,28%	0,30%	0,00%	0,08%	0,08%	0,76%	2,40%	**0,91%**
April	6,09%	5,56%	0,72%	0,31%	0,16%	0,16%	1,02%	2,42%	4,14%	**2,05%**
May	10,38%	6,25%	1,87%	0,23%	0,15%	0,53%	0,45%	3,71%	8,82%	**2,95%**
June	8,01%	5,51%	1,92%	0,67%	0,15%	0,53%	0,68%	3,61%	8,08%	**2,64%**
July	8,96%	5,16%	1,41%	0,29%	0,07%	0,08%	0,60%	2,08%	7,11%	**2,33%**
August	4,95%	2,72%	1,20%	0,14%	0,07%	0,15%	0,93%	1,63%	4,38%	**1,47%**
September	2,89%	0,71%	0,14%	0,23%	0,15%	0,08%	0,23%	0,46%	1,59%	**0,61%**
October	2,08%	0,72%	0,00%	0,07%	0,08%	0,00%	0,15%	0,81%	1,90%	**0,49%**
November	1,31%	0,28%	0,15%	0,23%	0,15%	0,00%	0,00%	0,08%	1,83%	**0,27%**
December	0,98%	0,27%	0,28%	0,29%	0,15%	0,15%	0,14%	0,22%	1,20%	**0,31%**
Average	**4,57%**	**2,54%**	**0,69%**	**0,30%**	**0,12%**	**0,16%**	**0,42%**	**1,43%**	3,79%	**1,28%**

Figure 35 CWA ceiling and/or visibility below EASA pre-flight planning minima for destination alternate aerodromes.

9.1.6 FAA pre-flight planning minima weather analysis datasets

CWA weather below FAA pre-flight planning minima for destination alternate aerodromes including consideration of further airline operator requirements:

This table shows the probability for every time increment for the weather to be below the applicable FAA pre-flight planning minima for CWA as destination alternate aerodrome and includes further airline operator requirements as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	4,82%	2,53%	2,99%	4,46%	5,20%	7,58%	7,36%	3,05%	4,48%	**4,75%**
February	5,85%	3,04%	2,16%	2,61%	3,55%	5,52%	4,77%	3,13%	4,83%	**3,83%**
March	8,32%	5,67%	3,32%	3,49%	2,95%	3,19%	2,58%	3,49%	5,86%	**4,12%**
April	11,29%	10,28%	4,24%	3,34%	3,86%	2,62%	4,15%	5,53%	7,81%	**5,66%**
May	15,71%	13,31%	6,85%	5,18%	5,51%	3,98%	3,78%	8,58%	14,28%	**7,86%**
June	16,71%	13,58%	6,74%	6,44%	8,67%	5,64%	5,67%	10,01%	15,35%	**9,18%**
July	16,27%	13,35%	7,18%	5,97%	7,12%	4,81%	4,03%	6,83%	12,66%	**8,20%**
August	10,16%	9,28%	7,75%	8,13%	9,12%	6,71%	5,15%	5,67%	9,33%	**7,75%**
September	7,67%	6,96%	5,92%	5,25%	6,84%	5,13%	4,79%	4,46%	5,95%	**5,88%**
October	4,55%	3,89%	3,47%	3,72%	4,97%	4,06%	3,52%	4,28%	4,47%	**4,06%**
November	4,25%	3,16%	3,97%	6,57%	7,98%	6,37%	4,49%	2,73%	4,86%	**4,94%**
December	3,02%	1,98%	2,39%	4,74%	5,01%	5,11%	4,90%	2,54%	3,30%	**3,71%**
Average	**9,05%**	**7,25%**	**4,75%**	**4,99%**	**5,90%**	**5,06%**	**4,60%**	**5,02%**	7,77%	**5,83%**

Figure 36 CWA ceiling and/or visibility below FAA pre-flight planning minima for destination alternate aerodromes

CWA ceiling and/or visibility below FAA pre-flight planning minima for destination alternate aerodromes

This table shows the probability for every time increment for the weather to be below the applicable requirements for ceiling and/or visibility according to the FAA pre-flight planning minima for CWA as destination alternate aerodrome as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	4,22%	1,80%	1,46%	1,15%	0,37%	0,36%	1,00%	1,02%	2,98%	**1,42%**
February	5,48%	2,40%	1,16%	0,55%	0,40%	0,32%	1,43%	2,00%	4,24%	**1,72%**
March	8,11%	4,95%	2,33%	1,48%	0,30%	0,68%	0,76%	1,90%	4,88%	**2,56%**
April	10,85%	9,76%	3,30%	1,71%	1,65%	1,27%	2,98%	4,91%	7,43%	**4,55%**
May	14,87%	12,14%	5,67%	3,23%	2,01%	2,03%	2,49%	6,69%	13,60%	**6,14%**
June	14,85%	11,20%	4,81%	2,81%	2,32%	2,06%	2,80%	6,17%	13,15%	**5,88%**
July	14,87%	10,62%	4,96%	3,24%	2,25%	2,41%	2,76%	4,08%	11,53%	**5,65%**
August	9,29%	7,24%	5,14%	4,42%	1,64%	2,12%	3,44%	3,40%	7,88%	**4,59%**
September	5,99%	4,51%	2,74%	1,90%	1,38%	2,64%	3,57%	2,54%	4,66%	**3,16%**
October	3,91%	2,04%	0,79%	0,15%	0,15%	0,38%	0,75%	1,70%	3,41%	**1,23%**
November	3,40%	1,40%	0,88%	1,24%	0,46%	0,62%	0,46%	0,46%	3,15%	**1,12%**
December	2,36%	1,23%	0,49%	0,87%	0,36%	0,22%	0,50%	0,43%	1,94%	**0,81%**
Average	**8,18%**	**5,78%**	**2,81%**	**1,90%**	**1,11%**	**1,26%**	**1,91%**	**2,94%**	6,57%	**3,24%**

9.1.7 Pre-flight planning minima weather datasets applicable to ICAO, EASA, FAA, CASA regulation

CWA wind speeds above pre-flight planning minima for destination alternate aerodromes considering airline operator requirements (valid for ICAO, EASA, FAA, CASA regulations)

This table shows the probability for every time increment for the wind speeds at CWA to be above the applicable wind limits considering ICAO, EASA, FAA, and CASA based pre-flight planning minima, as well as airline operator requirements, for CWA as destination alternate aerodrome as specified in chapter 7.3 Methodology.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	0,60%	0,80%	1,53%	3,38%	4,83%	7,36%	6,71%	2,04%	1,42%	**3,41%**
February	0,30%	0,85%	1,16%	2,06%	3,15%	5,12%	3,34%	1,04%	0,52%	**2,13%**
March	0,28%	0,72%	1,13%	1,78%	2,50%	2,28%	1,14%	1,06%	0,84%	**1,36%**
April	0,51%	0,71%	0,72%	1,40%	2,13%	1,51%	1,17%	0,62%	0,40%	**1,10%**
May	0,77%	1,49%	1,38%	2,10%	3,87%	2,03%	1,21%	1,96%	0,64%	**1,85%**
June	2,07%	2,75%	2,13%	4,00%	6,73%	3,74%	3,25%	4,06%	2,43%	**3,59%**
July	1,46%	3,38%	2,48%	3,17%	5,55%	2,48%	1,34%	2,82%	1,25%	**2,84%**
August	1,07%	2,26%	3,14%	4,00%	7,98%	5,25%	2,79%	2,27%	1,76%	**3,59%**
September	2,29%	3,22%	3,32%	3,73%	6,07%	2,79%	1,90%	2,46%	1,89%	**3,22%**
October	0,63%	1,84%	2,67%	3,57%	4,82%	3,46%	2,47%	2,36%	1,09%	**2,73%**
November	0,85%	1,83%	2,94%	5,41%	7,22%	5,98%	3,95%	1,75%	1,60%	**3,74%**
December	0,66%	0,75%	1,97%	3,86%	4,36%	4,89%	4,33%	1,88%	1,34%	**2,84%**
Average	**0,96%**	**1,72%**	**2,05%**	**3,21%**	**4,93%**	**3,91%**	**2,80%**	**2,03%**	1,27%	**2,70%**

Figure 37 CWA wind speeds above pre-flight planning minima for destination alternate aerodromes considering airline operator requirements (valid for ICAO, EASA, FAA, CASA based regulations).

Weather threat events, which prevent CWA from being planned as destination alternate aerodrome (valid for ICAO, EASA, FAA, CASA regulations)

This table shows the probability for every time increment for the presence of weather threat events which prevent CWA to be planned as destination alternate aerodrome considering ICAO, EASA, FAA, and CASA based pre-flight planning minima, as well as airline operator requirements, for CWA as destination alternate aerodrome as specified in chapter 7.3 Methodology. Weather threats in this context include thunderstorm, heady shower of precipitation, hail, and windshear.

	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,08%	**0,00%**
February	0,07%	0,00%	0,00%	0,00%	0,00%	0,08%	0,00%	0,08%	0,06%	**0,03%**
March	0,00%	0,00%	0,00%	0,22%	0,15%	0,23%	0,68%	0,53%	0,20%	**0,23%**
April	0,00%	0,00%	0,29%	0,23%	0,16%	0,00%	0,00%	0,00%	0,10%	**0,08%**
May	0,07%	0,00%	0,00%	0,00%	0,00%	0,00%	0,08%	0,00%	0,04%	**0,02%**
June	0,28%	0,13%	0,07%	0,00%	0,07%	0,00%	0,00%	0,23%	0,10%	**0,10%**
July	0,07%	0,12%	0,20%	0,00%	0,00%	0,00%	0,07%	0,00%	0,00%	**0,06%**
August	0,07%	0,00%	0,00%	0,00%	0,00%	0,00%	0,29%	0,14%	0,02%	**0,06%**
September	0,00%	0,06%	0,07%	0,15%	0,08%	0,00%	0,00%	0,00%	0,21%	**0,05%**
October	0,00%	0,00%	0,07%	0,00%	0,00%	0,23%	0,37%	0,22%	0,02%	**0,11%**
November	0,00%	0,00%	0,15%	0,23%	0,30%	0,00%	0,08%	0,68%	0,23%	**0,18%**
December	0,00%	0,00%	0,07%	0,22%	0,29%	0,00%	0,07%	0,22%	0,02%	**0,11%**
Average	**0,05%**	**0,03%**	**0,08%**	**0,09%**	**0,09%**	**0,04%**	**0,14%**	**0,18%**	0,09%	**0,09%**

Figure 38 Weather threat events (thunderstorms, heavy showers of precipitation, hail, and windshear) which prevent CWA to be planned as destination alternate aerodrome (valid for ICAO, EASA, FAA, CASA based regulations)

9.1.8 Pre-flight planning minima according to actual CPT timetable with Cat 1 at CWA weather analysis datasets

This table shows the probability for every time increment for the weather to be below the applicable pre-flight planning minima for CWA as destination alternate aerodrome with a Cat 1 ILS approach available and includes further airline operator requirements as specified in chapter 7.3 Methodology. The applicable pre-flight planning minima vary between the arrival times of different aircraft operators and are considered as defined in chapter 7.5 Results for actual CPT timetable.

Pre-flight minima considered	EASA	ICAO	EASA	ICAO	FAA	FAA	FAA	EASA		
	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	3,08%	1,20%	1,67%	3,89%	5,20%	7,58%	7,36%	2,33%	3,15%	**4,04%**
February	3,40%	1,41%	1,31%	2,37%	3,55%	5,52%	4,77%	2,16%	2,93%	**3,06%**
March	3,95%	2,08%	1,34%	2,30%	2,95%	3,19%	2,58%	2,35%	3,44%	**2,59%**
April	6,60%	5,49%	1,72%	1,94%	3,86%	2,62%	4,15%	3,04%	4,64%	**3,68%**
May	11,22%	6,07%	3,25%	2,25%	5,51%	3,98%	3,78%	5,60%	9,50%	**5,21%**
June	10,22%	7,01%	3,99%	4,44%	8,67%	5,64%	5,67%	7,67%	10,57%	**6,67%**
July	10,49%	7,30%	4,02%	3,39%	7,12%	4,81%	4,03%	4,90%	8,36%	**5,76%**
August	6,08%	4,41%	4,28%	4,07%	9,12%	6,71%	5,15%	4,04%	6,16%	**5,48%**
September	5,18%	3,87%	3,54%	3,96%	6,84%	5,13%	4,79%	2,92%	3,58%	**4,53%**
October	2,71%	2,50%	2,75%	3,64%	4,97%	4,06%	3,52%	3,39%	3,01%	**3,44%**
November	2,16%	1,90%	3,23%	5,88%	7,98%	6,37%	4,49%	2,43%	3,66%	**4,30%**
December	1,64%	0,95%	2,25%	4,37%	5,01%	5,11%	4,90%	2,32%	2,56%	**3,32%**
Average	**5,56%**	**3,68%**	**2,78%**	**3,54%**	**5,90%**	**5,06%**	**4,60%**	**3,60%**	5,13%	**4,34%**

9.1.9 flight planning minima according to actual CPT timetable with Cat 3 at CWA weather analysis datasets

This table shows the probability for every time increment for the weather to be below the applicable pre-flight planning minima for CWA as destination alternate aerodrome with a Cat 3 ILS approach available and includes further airline operator requirements as specified in chapter 7.3 Methodology. The applicable pre-flight planning minima vary between the arrival times of different aircraft operators and are considered as defined in chapter 7.5 Results for actual CPT timetable.

Pre-flight minima considered	EASA	ICAO	EASA	ICAO	FAA	FAA	FAA	EASA		
	06-08	08-10	10-12	12-14	14-16	16-18	18-20	20-22	<06 & >22	**Average**
January	3,08%	0,93%	1,67%	3,89%	5,20%	7,58%	7,36%	2,33%	3,15%	**4,00%**
February	3,40%	1,13%	1,31%	2,37%	3,55%	5,52%	4,77%	2,16%	2,93%	**3,03%**
March	3,95%	1,30%	1,34%	2,30%	2,95%	3,19%	2,58%	2,35%	3,44%	**2,50%**
April	6,60%	3,75%	1,72%	1,94%	3,86%	2,62%	4,15%	3,04%	4,64%	**3,46%**
May	11,22%	4,89%	3,25%	2,25%	5,51%	3,98%	3,78%	5,60%	9,50%	**5,06%**
June	10,22%	6,32%	3,99%	4,37%	8,67%	5,64%	5,67%	7,67%	10,57%	**6,57%**
July	10,49%	6,77%	4,02%	3,39%	7,12%	4,81%	4,03%	4,90%	8,36%	**5,69%**
August	6,08%	3,74%	4,28%	4,00%	9,12%	6,71%	5,15%	4,04%	6,16%	**5,39%**
September	5,18%	3,74%	3,54%	3,96%	6,84%	5,13%	4,79%	2,92%	3,58%	**4,51%**
October	2,71%	2,11%	2,75%	3,64%	4,97%	4,06%	3,52%	3,39%	3,01%	**3,39%**
November	2,16%	1,90%	3,23%	5,88%	7,98%	6,37%	4,49%	2,43%	3,66%	**4,30%**
December	1,64%	0,75%	2,25%	4,37%	5,01%	5,11%	4,90%	2,32%	2,56%	**3,29%**
Average	**5,56%**	**3,11%**	**2,78%**	**3,53%**	**5,90%**	**5,06%**	**4,60%**	**3,60%**	5,13%	**4,27%**

End of Study