CIVIL AVIATION AUTHORITY OFNEPAL

Manual for the Determination and Approval of the Aerodrome Operating Minima

First Edition

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RECORD OF AMENDMENTS AND CORRIGENDA

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FOREWORD

This Manual has been prepared pursuant to **Clause-35 of Civil Aviation Authority of Nepal Act, 2053 (1996) and Rule-82 of Civil Aviation Regulation, 2058 (2002)**so as to fulfill the Requirement 4.2.8 of FOR-Aeroplane for the use and guidance to Flight Operations Inspectors in performing their duties especially while approving the methodology adopted by the operators in the determination of their Aerodrome Operating Minima (AOM).

It is emphasized that all matters pertaining to the issues related to the determination of AOM may not be completely covered up by this manual. The inspectors are expected to use their good judgment and refer to ICAO Doc 9365 or any other applicable documents in matters where specific guidance has not been given.

This manual includes the necessary checklist(s)so as to approve the minima developed by the operators. This manual is equally significant to the operators as it provides the necessary guidelines to them to determine the appropriate AOM for the airports of Nepal wherever applicable. This manual also provides reference for depiction of visibility minima in the instrument charts.

This is a controlled document and is subject to periodic review. Flight Safety Standards Department will maintain this document as complete, accurate and up-dated as possible. Comments and recommendations for the revision/amendment action to this publication should be forwarded to the Director of Flight Safety Standards Department, CAAN.

This manual will be effective on ..10.. February 2017.

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Sanjiv Gautam
Director General
Civil Aviation Authority of Nepal

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CHAPTER 1. DEFINITIONS AND ABBREVIATIONS

1.1 DEFINITIONS:

When the following terms are used in this manual they have the following meanings:

Aerodrome operating minima. The limits of usability of an aerodrome for:

a) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions;

b) landing in 2D instrument approach operations, expressed in terms of visibility and/or runway visual range, minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions; and

c) landing in 3D instrument approach operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the type and/or category of the operation.

All-weather operations. Any surface movement, take-off, departure, approach or landing operations in conditions where visual reference is limited by weather conditions.

Alternate aerodrome. An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing. Alternate aerodromes include the following:

Take-off alternate. An alternate aerodrome at which an aircraft can land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.

En-route alternate. An aerodrome at which an aircraft would be able to land after experiencing an abnormal or emergency condition while en route.

Destination alternate. An alternate aerodrome to which an aircraft may proceed should it become either impossible or inadvisable to land at the aerodrome of intended landing.

Note.— The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.

Approach Ban. Prohibition for an aircraft to commence the approach to land when weather conditions are reported to be below landing minima.

Approach and landing operations using instrument approach procedures. Instrument approach and landing operations are classified as follows:

Non-precision approach and landing operations. An instrument approach and landing in 2Dinstrument approach operations Type A.

Approach and landing operations with vertical guidance. A performance-based navigation (PBN) instrument approach and landing in 3D instrument approach operations Type A.

Precision approach and landing operations. An instrument approach and landing based on navigation systems (ILS, MLS, GLS and SBAS Cat I)in 3D instrument approach operations Type A or B.

Note 1. — Categories of precision approach and landing operations:

a) ***Type A****: a minimum descent height or decision height at or above 75 m (250 ft); and*

b) ***Type B****: a decision height below 75 m (250 ft). Type B instrument approach operations are categorized as:*

1) ***Category I (CAT I)****: a decision height not lower than 60 m (200 ft) and with either a visibility not less than 800 m or a runway visual range not less than 550 m;*

2) ***Category II (CAT II)****: a decision height lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 300 m;*

3) ***Category IIIA (CAT IIIA)****: a decision height lower than 30 m (100 ft) or no decision height and a runway visual range not less than 175 m;*

4) ***Category IIIB (CAT IIIB)****: a decision height lower than 15 m (50 ft) or no decision height and a runway visual range less than 175 m but not less than 50 m; and*

5) ***Category IIIC (CAT IIIC)****: no decision height and no runway visual range limitations.*

Note 2.— Where decision height (DH) and runway visual range (RVR) fall into different categories of operation, the instrument approach operation would be conducted in accordance with the requirements of the most demanding category (e.g. an operation with a DH in the range of CAT IIIA but with an RVR in the range ofCAT IIIB would be considered a CAT IIIB operation or an operation with a DH in the range of CAT II but with an RVR in the range of CAT I would be considered a CAT II operation).

Approach ban point. The point from which an instrument approach shall not be continued below 300 m (1000 ft) above the aerodrome elevation or into the final approach segment unless the reported visibility or controlling RVR is above the aerodrome operating minima.

Automatic flight control system (AFCS) with coupled approach mode. An airborne system which provides automatic control of the flight path of the aeroplane during approach.

Automatic landing system. The airborne system which provides automatic control of the aeroplane during the approach and landing.

Categories of aeroplanes. The following five categories of aeroplanes have been established based on 1.3 times the stall speed in the landing configuration at maximum certificated landing mass:

Category A — less than 169 km/h (91 kt) IAS
Category B — 169 km/h (91 kt) or more but less than 224 km/h (121 kt) IAS
Category C — 224 km/h (121 kt) or more but less than 261 km/h (141 kt) IAS

Category D — 261 km/h (141 kt) or more but less than 307 km/h (166 kt) IAS
Category E — 307 km/h (166 kt) or more but less than 391 km/h (211 kt) IAS.

Categories of approach operations. (See Approach and landing operations using instrument approach procedures.)

Ceiling. The height above the ground or water of the base of the lowest layer of cloud below 6 000 m (20 000 ft)covering more than half the sky.

Circling approach. An extension of an instrument approach procedure which provides for visual circling of the aerodrome prior to landing.

Commercial air transport operation. An aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire.

Continuous descent final approach (CDFA). A technique, consistent with stabilized approach procedures, for flying the final approach segment of a non-precision instrument approach procedure as a continuous descent, without level-off, from an altitude/height at or above the final approach fix altitude/height to a point approximately 15 m(50 ft) above the landing runway threshold or the point where the flare manoeuvre should begin for the type of aircraft flown.

Converted meteorological visibility (CMV). A value (equivalent to an RVR) which is derived from the reported meteorological visibility.

Decision altitude (DA) or decision height (DH). A specified altitude or height in a 3D instrument approach operation at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

Note 1.— Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the threshold elevation.

Note 2.— The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In Category III operations with a decision height the required visual reference is that specified for the particular procedure and operation.

Note 3.— For convenience where both expressions are used they may be written in the form “decision altitude/height” and abbreviated “DA/H”.

Enhanced vision system (EVS). A system to display electronic real-time images of the external scene achieved through the use of image sensors.

Final approach. That part of an instrument approach procedure which commences at the specified final approach fix or point, or where such a fix or point is not specified,

a) at the end of the last procedure turn, base turn or inbound turn of a racetrack procedure, if specified; or
b)at the point of interception of the last track specified in the approach procedure; and ends at a point in the vicinity of an aerodrome from which:

1) a landing can be made; or
2) a missed approach procedure is initiated.

Final approach segment. That segment of an instrument approach procedure in which alignment and descent for landing are accomplished.

Flight visibility. The visibility forward from the cockpit of an aircraft in flight.

GLS. An instrument approach operation that is based on GBAS.

Ground-based augmentation system (GBAS). An augmentation system in which the user receives augmentation information directly from a ground-based transmitter.

Head-up display (HUD). A display system that presents flight information into the pilot's forward external field of view.

Head-up display (HUD) approach and landing guidance system (HUDLS). An airborne instrument system which presents sufficient information and guidance in a specific area of the aircraft windshield, superimposed for a conformal view with the external visual scene, which permits the pilot to manoeuvre the aircraftmanually by reference to that information and guidance alone to a level of performance and reliability that is acceptable for the category of operation concerned.

Instrument approach operations. An approach and landing using instruments for navigation guidance based on an instrument approach procedure. There are two methods for executing instrument approach operations:

a) a two-dimensional (2D) instrument approach operation, using lateral navigation guidance only; and

b) a three-dimensional (3D) instrument approach operation, using both lateral and vertical navigation guidance.

Note.— Lateral and vertical navigation guidance refers to the guidance provided either by:
a) a ground-based radio navigation aid; or
b) computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of these.

Instrument approach procedure (IAP). A series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply. Instrument approach procedures are classified as follows:

Non-precision approach (NPA) procedure. An instrument approach procedure designed for 2D instrument approach operations Type A.

Note.— Non-precision approach procedures may be flown using a continuous descent final approach (CDFA) technique. CDFAs with advisory VNAV guidance calculated by on-board equipment are considered 3D instrument approach operations. CDFAs with manual calculation of the required rate of descent are considered 2D instrument approach operations.

Approach procedure with vertical guidance (APV). A performance-based navigation (PBN) instrument approach procedure designed for 3D instrument approach operations Type A.

Precision approach (PA) procedure. An instrument approach procedure based on navigation systems (ILS, MLS, GLS and SBAS Cat I) designed for 3D instrument approach operations Type A or B.

Instrument flight rules (IFR). A set of rules governing the conduct of flight under instrument meteorological conditions.

Note.— IFR specifications are found in Chapter 5 of CAR 2. Instrument flight rules may be followed in both IMC and VMC.

Instrument meteorological conditions (IMC). Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minima specified for visual meteorological conditions.

Note.— The specified minima for visual meteorological conditions are contained in Chapter 4 of CAR 2.

Low visibility procedures (LVP). Specific procedures applied at an aerodrome for the purpose of ensuring safe operations during Category II and III approaches and/or low visibility take-offs.

Low visibility take-off (LVTO). A term used by the European authorities in relation to flight operations referring to a take-off on a runway where the RVR is less than 400 m.

Minimum descent altitude (MDA) or minimum descent height (MDH). A specified altitude or height in a non-precision approach or circling approach below which descent must not be made without the required visual reference.

Note 1.— Minimum descent altitude (MDA) is referenced to mean sea level and minimum descent height (MDH) is referenced to the aerodrome elevation or to the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. A minimum descent height for a circling approach is referenced to the aerodrome elevation.

Note 2.— The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In the case of a circling approach the required visual reference is the runway environment.

Note 3.— For convenience when both expressions are used they may be written in the form “minimum descent altitude/height” and abbreviated “MDA/H”.

Missed approach point (MAPt). That point in an instrument approach procedure at or before which the prescribed missed approach procedure must be initiated in order to ensure that the minimum obstacleclearance is not infringed.

Missed approach procedure. The procedure to be followed if the approach cannot be continued.

Obstacle clearance altitude (OCA) or obstacle clearance height (OCH). The lowest altitude or the lowest height above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria.

Note 1.— Obstacle clearance altitude is referenced to mean sea level and obstacle clearance height is referenced to the threshold elevation or in the case of non-precision approaches to the aerodrome elevation or the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. An obstacle clearance height for acircling approach is referenced to the aerodrome elevation.

Note 2.— For convenience when both expressions are used they may be written in the form "obstacle clearance altitude/ height" and abbreviated "OCA/H".

Performance-based navigation (PBN). Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

Note.— Performance requirements are expressed in navigation specifications (RNAV specification, RNP specification) in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept.

Procedure turn. A manoeuvre in which a turn is made away from a designated track followed by a turn in the opposite direction to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

Note 1.— Procedure turns are designated "left" or "right" according to the direction of the initial turn.

Note 2.— Procedure turns may be designated as being made either in level flight or while descending, according to the circumstances of each individual instrument approach procedure.

Required navigation performance (RNP). A statement of the navigation performance necessary for operation within a defined airspace.

Note.— Navigation performance and requirements are defined for a particular RNP type and/or application.

Runway visual range (RVR). The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

Stabilized approach. An approach which is flown in a controlled and appropriate manner in terms of configuration, energy and control of the flight path from a pre-determined point or altitude/height down to a point 50 feet above the threshold or the point where the flare manoeuvre is initiated, if higher.

State of the Aerodrome. The State in whose territory the aerodrome is located.

Surveillance radar. Radar equipment used to determine the position of an aircraft in range and azimuth.

Touchdown zone (TDZ). The portion of a runway, beyond the threshold, where it is intended landing aeroplanes first contact the runway.

Vertical navigation (VNAV). A method of navigation which permits aircraft operation on a vertical flight profile using altimetry sources, external flight path references, or a combination of these.

Visibility. Visibility for aeronautical purposes is the greater of:
a) the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;
b) the greatest distance at which lights in the vicinity of 1 000 candelas can be seen and identified against an unlit background.

Note 1.— The two distances have different values in air of a given extinction coefficient, and the latter b) varies with the background illumination. The former a) is represented by the meteorological optical range (MOR).

Note. 2.— The definition applies to the observations of visibility in local routine and special reports, to the observations of prevailing and minimum visibility reported in METAR and SPECI and to the observations of ground visibility.

Visual approach. An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed by visual reference to terrain.

Visual flight rules (VFR). A set of rules governing the conduct of flight under visual meteorological conditions.

Note.— VFR specifications are found in Chapter 4 of CAR 2.

Visual meteorological conditions (VMC). Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, equal to or better than specified minima.

Note.— The specified minima for visual meteorological conditions are contained in Chapter 4 of CAR 2.

1.2 ABBREVIATIONS

AFCS	Automatic flight control system
AFM	Aeroplane flight manual
AIC	Aeronautical information circular
AIP	Aeronautical information publication
AIREP	Air report
AIS	Aeronautical information service
AOC	Air operator certificate
AOM	Aerodrome operating minima
APV	Approach procedure with vertical guidance
ATC	Air traffic control
ATIS	Automatic terminal information service
ATS	Air traffic services
BALS	Basic approach lighting system
CAT I	Category I
CAT II	Category II
CAT III	Category III
CDFA	Continuous descent final approach
CFIT	Controlled flight into terrain
CMV	Converted meteorological visibility
DA	Decision altitude
DA/H	Decision altitude/height
DH	Decision height
DME	Distance measuring equipment
EVS	Enhanced vision system
FAF	Final approach fix
FALS	Full approach lighting system
FMS	Flight management system
GBAS	Ground-based augmentation system
GLS	GBAS landing system
GNSS	Global navigation satellite system
GS	Glide slope
HATh	Height above threshold
HIALS	High intensity approach lighting system
HUD	Head-up display
HUDLS	Head-up display landing system
IALS	Intermediate approach lighting system
IAS	Indicated airspeed
IFR	Instrument flight rules
ILS	Instrument landing system
IMC	Instrument meteorological conditions
JAA	Joint Aviation Authorities
LOC	Localizer

LNAV	Lateral navigation
LVP	Low visibility procedures
MAPt	Missed approach point
MDA	Minimum descent altitude
MDA/H	Minimum descent altitude/height
MDH	Minimum descent height
MET	Meteorological
METAR	Aviation routine weather report
MFDA AOM	Manual for the Determination and Approval of Aerodrome Operating Minima
MIALS	Medium intensity approach and lighting system
MLS	Microwave landing system
MOC	Minimum obstacle clearance
NALS	No approach lighting system
NDB	Non-directional beacon
NOTAM	Notice to airmen
OCA	Obstacle clearance altitude
OCA/H	Obstacle clearance altitude/height
OCH	Obstacle clearance height
PAR	Precision approach radar
RCLL	Runway centre line lights
RNAV	Area navigation
RNP	Required navigation performance
RTZL	Runway touchdown zone lights
RVR	Runway visual range
SID	Standard instrument departure
SIGMET	Significant weather report
SRA	Surveillance radar approach
STAR	Standard instrument arrival
TDZ	Touchdown zone
TERPs	Terminal Instrument Procedures
THR	Threshold
VDF	Very high frequency direction-finding station
VFR	Visual flight rules
VIS	Visibility
VMC	Visual meteorological conditions
VNAV	Vertical navigation
VOR	Very high frequency Omni-directional radio range

CHAPTER 2. GENERAL

2.1 OBJECTIVES

This procedure manual has been developed in order to fulfill the following prime objectives:

1. To provide the guidelines to the Flight Operations Inspector(s) while approving the methods used by the Operators on determining aerodrome operating minima as described under Requirement 4.2.8 of Flight Operations Requirement.

2. To provide guidelines to the operators for the establishment of aerodrome operating minima in order to ensure a desired level of safety for aeroplane operations at an aerodrome by limiting these operations in specified weather conditions.

3. To provide reference for the depiction of aerodrome minima in the instrument charts.

2.2 APPLICABILITY

This procedure manual is applicable to the regulatory authorities especially the FSSD and its inspectors, and aeroplane operators and their personnel. However, the manual is also useful to the aerodrome operators and flight procedure design agency or its designers.

2.3 REFERENCES

Following documents are referred while developing this procedure manual:

1. AOCR (2nd Edition, 2nd Amdt.) Req. 2.1.2 and 6.1.3.2.3,
2. FOR 4.2.8 and 4.4.1,
3. AOCI Manual, Vol. 1 and 2
4. Manual of All Weather Operations, ICAO Doc. 9365
5. Operation of Aircraft. ICAO Annex 6, Part 1, Aerodrome Operating Minima, Std. 4.2.8
6. ICAO Doc. 8168 Vol. 1 and Vol. 2, PANS OPS

2.4 AUTHORITY FOR PUBLICATION AND AMENDMENT

2.4.1 The authority responsible for the issuance and control of amendments to this manual is Flight Safety Standard Department.

2.4.2 All users of this manual are encouraged to submit recommendations for proposed revisions, additions or omissions to the authority for consideration and inclusion in the amendments as appropriate.

CHAPTER 3. BASIC CONCEPT OF AERODROME OPERATING MINIMA

3.1 Introduction

3.1.1 Aerodrome operating minima are established in order to ensure a desired level of safety for aeroplane operations at an aerodrome by limiting these operations in specified weather conditions. Such minima are generally expressed differently for take-off and for landing.

3.1.2 For take-off, which commences with the aeroplane at rest, limitations are usually stated in terms of horizontal visibility, but in instances where there is a need for obstacle identification during take-off, limitations may be stated in terms of horizontal visibility and ceiling or vertical visibility.

3.1.3 For the approach, limitations are usually stated in terms of decision altitude/height (DA/H) or minimum descent altitude/height (MDA/H) established together with the limitation of horizontal visibility. A ceiling or vertical visibility limitation for the decision to continue the approach to land is normally not applied since a safe flight path to DA/H or MDA/H is assured by the flight procedure design.

3.2 Factors to be considered for the determination of aerodrome operating minima

3.2.1 The values of aerodrome operating minima for a particular operation shall ensure that the combination of information available from external sources and the aeroplane instruments and equipment is sufficient to enable the aeroplane to be operated along the required flight path. As the amount and quality of external visual information decreases, the quality and quantity of instrument and equipment information, as well as the proficiency of the flight crew, shall increase in order to maintain the desired level of safety. In determining the values of aerodrome operating minima, a largenumber of factors are involved which fall primarily into three groups as follows:

a. the ground environment and the design, maintenance and operation of ground equipment;
b. the characteristics of the aeroplane and its equipment; and
c. the operator’s procedures, flight crew training and experience.

3.3 Flight phases to be considered

The flight phases to be considered in the determination of aerodrome operating minima are:

a. surface movement from the aeroplane stand to the start of take-off, and from the end of the landing roll to the aeroplane stand;
b. take-off and initial climb; and
c. final approach, landing and roll-out.

The minimum visibility required for take-off and landing is, in most cases, greater than that necessary for surface movement.

3.4 Factors for determining AOM

In general, the aerodrome operating minima shall be derived taking into consideration of following factors:

a. aircraft equipage;
b. navigation aid capability;
c. the sophistication of the aerodrome infrastructure such as lights and markings;
d. the role of ATS and/or the facility's maintenance personnel in monitoring the navigation aid and protecting critical and sensitive areas, etc.; and
e. the operating policies, procedures and instructions imposed by the authority.

3.5 Determining factors for surface movement

3.5.1 There are no minimum visibility requirements for taxi. The pilot-in-command is ultimately responsible for ensuring clearance from other aircraft, vehicles and obstacles. For low visibility operations, it is common that aerodromes are required, directly or indirectly, to have low visibility procedures in place to enhance safety during low visibility ground operations. Such systems need to be proportional to the traffic volume and the complexity of the aerodrome. Air operators shall have policies and procedures for low visibility taxi operations.

3.6 Determining factors for take-off and initial climb minima

3.6.1 For take-off, the visual reference available shall be sufficient to enable the pilot to keep the aeroplane within acceptable limits relative to the runway centre line throughout the take-off roll until it is either airborne or has been brought to a stop following discontinuation of the take-off.

3.6.2 The guidance available should enable the pilot to judge the aeroplane lateral position and rate of change of position. This is normally provided by external visual cues, such as runway edge lighting, runway centre line lighting and runway marking, but these may be supplemented by instrument- derived guidance (e.g. head-up display guidance).

3.6.3 In establishing take-off minima, due consideration shall be given to the need for the pilot to continue to have adequate guidance in the event of abnormal situations or malfunctions of the aeroplane systems such as an engine failure. It also should be ensured that once the aeroplane is airborne, sufficient instrument or visual guidance is available to enable a flight path to remain clear of obstacles.

3.6.4 Minimum visibility or RVR for take-off depends on the visual cues provided for along the runway. In cases where the take-off phase is guided or supplemented by instrumental means, the required visibility/RVR may be reduced.

3.7 Determining factors for final approach and landing minima

3.7.1 For approach and landing, the specific considerations involved in the determination of aerodrome operating minima are:

a. the accuracy with which the aeroplane can be controlled along its desired approach path,

   i. by reference to the instrumentation and use of the equipment provided on board, and
   ii. by utilization of the guidance provided by navigation aids;

b. the characteristics of:
   i. the aeroplane (e.g. size, speed, missed approach performance)
   ii. the ground environment (e.g. obstacles in the approach or missed approach areas, availability of visual and non-visual aids);
c. the proficiency of the flight crew in the operation of the aeroplane;
d. the flight technique applied, whether the final approach is flown applying:
   i. a continuous descent final approach (CDFA) technique, or
   ii. a step down technique is used;
e. the extent to which external visual information is required for use by the pilot in controlling the aircraft; and
f. the interaction of all these factors in demonstrating satisfactory total system performance.

3.8 Effect of navigation performance on landing minima

3.8.1 The accuracy, integrity and continuity of the airborne and ground-based guidance and control systems generally determine the size of the area in which obstacles need to be considered. A more accurate system will require a smaller area.

3.8.2 As a general rule,

a. the smaller area means fewer obstacles need to be considered, which generally results in lower obstacle clearance height and lower landing minima (i.e. lower DA/H or MDA/H and RVR/VIS).
b. the better performance allows lower minima.

3.8.3 The area width required for obstacle evaluation is determined by the navigation capability of the aircraft and the ground and/or space element.

3.8.4 The continual development of diverging systems, together with the increase in airborne capabilities and the development of PBN concept, has led to a fundamental change in determining the operating minima.

3.8.5 Precision approach and landing operations optimize required protection in the vertical dimension. Approaches designed without vertical guidance require larger horizontal protected airspace. With vertical guidance, the protected airspace more closely follows the vertical flight path, eliminating potential obstacles.

3.8.6 The final approach track may not be aligned with the runway. In such cases, additional visibility/RVR is to be required in order to allow the pilot sufficient time to assess the position of the aircraft relative to the runway.

3.9 Visibility/RVR requirement

3.9.1 The visibility element for landing minima is determined by the task the pilot is required to carry out below DA/H or MDA/H in order to complete the landing safely and depends on the extent of the visual reference that the pilot requires. As a general rule, a higher DA/H or MDA/H result in a greater visibility/RVR minima.

3.9.2 The visibility element for take-off minima is determined by the task the pilot is required to carry out during take-off roll in judging the aeroplane lateral position and keeping the aeroplane in the acceptable limits relative to the runway centerline with the help of external visual cues, such as runway edge lighting, runway centre line lighting and runway marking, but these may be supplemented by instrument-derived guidance (e.g. head-up display guidance).

3.10 Continuous descent final approach (CDFA)

3.10.1 Utilization of a CDFA flight technique is recommended to reduce the risk of CFIT. Where a CDFA technique is not applied, e.g. if a step down approach technique has been used, there is a need for additional visibility/RVR. If the approach is not stable at a critical point, the pilot may need additional reaction time for the vertical manoeuvre.

3.10.2 The CDFA is achieved by means of time-to-height cross-checks, the use of a flight path angle or a pre-stored flight path based on the FMS capability in order to follow the optimum descent path to supplement the lateral guidance. Upon reaching MDA/H, an immediate decision is to be made to either go around or to continue the descent and make a landing within the touchdown zone.

3.10.3 When executing an approach without using a CDFA technique, the visibility/RVR minima in the Table 5-1 shall be increased by 200 m for CAT A and B aircraft and by 400 m in the case of CAT C and D to aidthe visual transition to landing.

3.11 Approach ban policy

3.11.1 Approach ban policy is intended to facilitate the regularity of instrument approach operations, to prevent a landing/go-around decision at a low altitude and in a vulnerable condition, and to minimize unnecessary instrument approach operations where a successful landing would be highly unlikely.

3.11.2 Approach ban limits aircraft from proceeding beyond a point Initial Approach Fix (IAF) on an instrument approach procedure, unless weather conditions are reported at or above a specified minimum. If RVR/Visibility falls below the applicable minimum after an aircraft has passed the approach ban point, the manual permits the aircraft to continue to DA/H or MDA/H.

3.11.3 Where the RVR is not available, RVR values may be derived by converting the reported visibility. The conversion factor from reported meteorological visibility to RVR value is mentioned in Appendix C.

CHAPTER 4. APPROVAL PROCEDURE FOR AERODROME OPERATING MINIMA

4.1 INTRODUCTION- APPROVAL OF METHODS AND COMPLIANCE

4.1.1 In accordance with FOR- Aeroplane, Para 4.2.8.1, all the operators shall establish the aerodrome operating minima. Civil Aviation Authority of Nepal (CAAN) is responsible for the approval of the method used to establish such minima and for supervising compliance with the rules or procedures as prescribes for the operation as a whole. For the operator to meet the foregoing obligations, the authority[1] is required to publish data (e.g. OCA/H, precise details of visual and electronic aids, pre- threshold terrain, obstacles) necessary for the operator to determine the appropriate aerodrome operating minima. Recognizing the need for an operator to conform with the requirements or procedures laid down by CAAN, the operator if operating out of Nepal shall also account for any restrictions which might be applied by the State of the Aerodrome.

4.1.2 The nature of limited visibility operations necessitates a clear presentation of the requirements of the CAAN and an agreed-upon means of indicating authorization and approval to achieve full utilization of facilities in international operations. There are five elements involved in the approval of an operation by the CAAN:

a) authorization of the aeroplane and its equipment;
b) authorization of the use of the aerodrome;
c) authorization of the flight crew;
d) authorization of the operation; and
e) authorization of minima.

4.1.3 The CAAN FOIs while authorizing the minima of the operators shall follow the checklist as mentioned in the Appendix F.

4.2 AUTHORIZATION OF THE AEROPLANE AND ITS EQUIPMENT

Authorization of the aeroplane and its equipment shall be indicated by appropriate entries in the flight manual and the operations manual. Any limitations or procedures necessary for the safe use of the system shall be identified, including but not limited to:

a) the DA/H or MDA/H limitations and any other relevant aerodrome operating minima with which the authorization is associated;
b) the minimum airborne equipment required before an approach in limited visibility conditions may be planned and carried out;
c) the equipment operating procedures such as use of the automatic flight control and automatic landing systems, if installed, and use of the flight instrument systems, system operating sequences, etc.;

[1]In case of aerodrome in foreign land, the authority is the CAA of State of Aerodrome; otherwise, it is CAAN.

d) detailed performance data relevant to the approach procedure which may differ from or be additional to normal aircraft certification data, such as loss of height during the missed approach procedure; and

e) any other factors affecting the use of the aeroplane in limited visibility conditions, such as the procedures to be followed if the aeroplane's climb performance after take-off or during a missed approach is seriously reduced with an engine inoperative.

4.3 AUTHORIZATION OF THE USE OF THE AERODROME

4.3.1 While authorizing the minima, FOIs shall ensure that the operators has considered for the proper allowance for the facilities available at an aerodrome when establishing operating minima. It doing so, it is expected that:

a. the State of the Aerodrome authorizes use of the facilities and services only if they meet the relevant ICAO specifications;
b. the appropriate OCA/H is published by the State of the Aerodrome; and
c. where the State of the Aerodrome has established the aerodrome operating minima, the minima authorized for the use of an operator by the CAAN is not lower than the former, except where specifically authorized by the State of the Aerodrome.

4.3.2 To facilitate these procedures, it is essential that up-to-date information be available on the facilities and procedures in use at each aerodrome as promulgated by aerodrome authority through its aeronautical information service.

4.4 AUTHORIZATION OF THE FLIGHT CREW

4.4.1 In fulfilling the requirements of FOR- Aeroplane, FOIs shall ensure, either directly or by delegated authority, that flight crews and individual flight crew members are qualified to operate to the applicable aerodrome operating minima.

4.4.2 As per PELR 2010 and FOR- Aeroplane, it is required that:

a. the pilot-in-command and co-pilot each hold an instrument rating and meet the requirements for established experience;
b. flight crew members are qualified and trained for take-off, instrument approaches and operations to the lowest Category I operations minima and, where required for low visibility take-off and Category II or III operations;
c. flight crew members have completed all required proficiency checks, including demonstration of proficiency using the relevant types of instrument approaches; and
d. the pilot-in-command has the necessary experience in the aeroplane type with restricted (higher)minima before being authorized to use the lowest approved minima.

4.4.3 The operator shall maintain a system of records to ensure that the necessary qualifications of the flight crew members are being met on a continuing basis.

4.5 AUTHORIZATION OF THE OPERATION

4.5.1 The precise method by which operational approvals are granted by the CAAN for operations in limited visibility conditions and the method by which compliance with established rules shall follow the following basic sequence:

a. application by the operator;
b. examination of the application by the CAAN FOIs;
c. issuance of an operational approval by the CAAN; and
d. continuing supervision of the operator to ensure compliance.

4.5.2 As a minimum, the FOIs shall ensure that the operator has established:

a. sufficient aerodrome operating minima for the use of flight crews for all types of approaches to all aerodromes to be used in the operations;
b. the proficiency of flight crews;
c. operating procedures;
d. operations manual instructions appropriate to the operation and that reflect the mandatory procedures and/or limitations contained in the flight manual; and
e. that sufficient experience has been gained with the system in operational service in weather minima higher than those proposed.

4.5.3 The operator shall be authorized to carry out operations in limited visibility by the issue of an approval for aerodrome operating minima to all applicable aerodromes.

CHAPTER 5. DETERMINATION OF AERODROME OPERATING MINIMA

Notes 1: While approving the AOM, FOIs are required to check the operator's methods of determination of AOM based on the guidelines of this chapter.

Note 2. Airline Operators are required to develop their AOM based on the guidelines of this chapter. Responsibilities of operators with regard to AOM and associated tasks are mentioned in the Appendix G.

5.1 INTRODUCTION

5.1.1 Aerodrome operating minima (AOM) are usually expressed as a minimum altitude or height and a minimum visibility or RVR.

5.1.2 For take-off, AOM are the indication of the minimum visibility or RVR conditions in which the pilot of an aeroplane may be expected to have available the external visual reference required for the control of the aeroplane along the surface of the runway until it is airborne or until the end of a rejected take- off.

5.1.3 For approach and landing, AOM are an expression of the minimum altitude or height by which the specified visual reference to be available and at which the decision to continue for landing or to execute a missed approach to be made. They are also an indication of the minimum visibility in which the pilot may have the visual information necessary for continued control of the flight path of the aeroplane during the visual phase of the approach, landing and roll-out.

5.1.4 The minimum visibility specified by the authority is to be used to prohibit commencement or continuation of an instrument approach or prohibit take-off if visibility is less than a specified value. The operators might have the more restrictive visibility.

5.1.5 The pilot is to be able to identify the centre line of the approach. In order to control the descent path, the pilot is to be able to see the touchdown area on the runway. In general, where the certified capability of the airborne and ground systems is greater, there is less need for visual references.

Note.— For "see to land" operations, the position of the aircraft relative to the runway is to be verified by one or more of the following visual references:

1. *elements of the approach lighting system;*
2. *threshold;*
3. *threshold markings;*
4. *threshold lights;*
5. *threshold identification lights;*
6. *visual glide slope indicator;*
7. *touchdown zone or touchdown zone markings;*
8. *touchdown zone lights;*
9. *runway edge lights; or*
10. *other visual references accepted by the authority.*

5.1.6 The tables of applied minima contained in this chapter are intended for use as guidance in the supervision of the operators in the determination of aerodrome operating minima. They are not intended to be taken as absolute values, and the determination of lower values is not precluded if such values result in an acceptable level of safety. Additionally, it is not intended that these values will be approved for an operator's use at DA/H below the relevant OCH value published for the aerodrome or below any other restricting minimum values that may be applied.

5.1.7 In the case of degradation of Aerodrome facilities or uncertainty of information prescribed for the determination of AOM, the operator shall increase of minima as per the guidelines mentioned in this manual. For example, Table 5-1 gives guidelines for degradation of approach lighting system. Increment of minima in case of lack of CDFA as mentioned in para 5.1.8.8.

5.1.8 Harmonization efforts and CDFA technique

5.1.8.1 The harmonization work for common method to determine the AOM is dependent upon the geometric relationship between HATh and the required RVR/visibility to specify necessary visual reference, taking account of the length of the approach lights provided, where HATh is the height above the aerodrome elevation mostly the DH, not lower than OCH.

5.1.8.2 A typical vertical descent path when utilizing a CDFA technique consists of a linear path which begins 50 feet above the runway threshold and extends to an altitude which ensures that the vertical pathwill remain above all altitudes in the final approach segment. Ideally a 3.00-degree vertical path angle, similar to CAT I approaches is desirable, however CDFA angles will vary based on local conditions (terrain, obstacles, wind, etc.).

5.1.8.3 If the execution of the CDFA will take the aircraft below the required altitude at a published step down fix on the approach procedure, the aircraft shall level off at the required minimum altitude or theCDFA shall be altered to meet this requirement. Altering a CDFA to accommodate this type of step- down fix will require the flight crew to begin the descent at a later point on the approach, resulting ina steeper descent angle. The default vertical path angle for the calculation is increased in incrementsof 0.10 degrees with each "height band" shown in Table 5-1until reaching the upper default value of 3.77 degrees (400 ft/NM).

5.1.8.4 The values in Table 5-1 are the lowest approved straight-in approach minima for instrument approach and landing operations other than CAT II or CAT III including the non-precision approach, and these values are to be considered while determining the AOM. Minima values used by the operators shall not be less than the tabulated values unless otherwise authorized.

5.1.8.5 Above tabulated values shall also be referred while depicting the minima in the approach charts.

5.1.8.6 Based upon the basic philosophy above, the minimum RVR/visibility can be derived from the following simple geometric relation:

Required RVR/visibility =[HATh(m)/Tan(approach slope)]-Length of approach light

For simplicity, the tabulated values to be used for the determination of minima unless otherwise the calculated values are more restrictive.

Table 5-1. Lowest straight-in approach minima
for instrument approach and landing operations other than CAT II or CAT III

DH or MDH (ft)	Class of lighting facility					DH or MDH (ft)	Class of lighting facility			
	FALS	IALS	BALS	NALS			FALS	IALS	BALS	NALS
	RVR (metres)						RVR(metres)			
	See 5.4.3.10 for RVR<750m						See 5.4.3.10 for RVR<750m			
200 - 210	550	750	1000	1200		541 - 560	1800	2100	2300	2500
211 - 220	550	800	1000	1200		561 - 580	1900	2200	2400	2600
221 - 230	550	800	1000	1200		581 - 600	2000	2300	2500	2700
231 - 240	550	800	1000	1200		601 - 620	2100	2400	2600	2800
241 - 250	550	800	1000	1300		621 - 640	2200	2500	2700	2900
251 - 260	600	800	1100	1300		641 - 660	2300	2600	2800	3000
261 - 280	600	900	1100	1300		661 - 680	2400	2700	2900	3100
281 - 300	650	900	1200	1400		681 - 700	2500	2800	3000	3200
301 - 320	700	1000	1200	1400		701 - 720	2600	2900	3100	3300
321 - 340	800	1100	1300	1500		721 - 740	2700	3000	3200	3400
341 - 360	900	1200	1400	1600		741 - 760	2700	3000	3300	3500
361 - 380	1000	1300	1500	1700		761 - 800	2900	3200	3400	3600
381 - 400	1100	1400	1600	1800		801 - 850	3100	3400	3600	3800
401 - 420	1200	1500	1700	1900		851 - 900	3300	3600	3800	4000
421 - 440	1300	1600	1800	2000		901 - 950	3600	3900	4100	4300
441 - 460	1400	1700	1900	2100		951 - 1000	3800	4100	4300	4500
461 - 480	1500	1800	2000	2200		1001 - 1100	4100	4400	4600	4900
481 - 500	1500	1800	2100	2300		1101 - 1200	4600	4900	5000	5000
501 - 520	1600	1900	2100	2400		1201 and above	5000	5000	5000	5000
521 - 540	1700	2000	2200	2400						

5.1.8.7 The following default values are inserted in the above relationship while developing the Table 5-1:

a. approach slope: 3.00 up to 3.77 degrees as indicated above;

b. the length of the approach lights set in this formula;
   - full length of the approach lights set at 720 m;
   - intermediate length of the approach lights: 420 m including at least one crossbar or equivalent;
   - basic length of the approach lights: 210 m; and

c. no approach lights: 0 m.

Note: Detail of Approach Lighting Systems is mentioned in Appendix A.

5.1.8.8 Increase tabulated values above by 200m for CAT A and B aircraft and by 400m for CAT C and CAT D aircraft if approach is without CDFA.

5.1.9 Tables of aerodrome operating minima

The tables of operating minima in this manual are intended to provide for standardized application and contain values of commonly acceptable minima. AOM are not necessarily absolute values but have been shown to maintain safety without adversely affecting operations. FOIs shall accept the values of operating minima which are lower than those in the tables if they are satisfied that the safety of operation can be maintained provided the operator demonstrates logical methods for establishing such minima.

5.2 TAKE-OFF MINIMA

5.2.1 Take-off minima are usually stated as visibility or RVR limits. Where there is a specific need to see and avoid obstacles on departure, take-off minima may include cloud base limits. Where avoidance of such obstacles may be accomplished by alternate procedural means, such as use of climb gradients or specified departure paths, cloud-base restrictions need not be applied. Take-off minima typically account for factors such as:

- terrain and obstacle avoidance,
- aircraft controllability and performance,
- visual aids available,
- runway characteristics,
- navigation and guidance available,
- non-normal conditions such as engine failure, and
- adverse weather including runway contamination or winds.

5.2.2 Following factors shall be referred by the operators in the determining their own minima:

a. flight characteristics and cockpit instrumentation typical of multi-engine turbine aircraft;
b. comprehensive programmes for crew qualification which address use of the specified minima;
c. comprehensive programmes for airworthiness, with any necessary equipment operational (MEL);
d. availability of specified facilities for the respective minima, including programmes for assurance of the necessary reliability and integrity;
e. availability of air traffic services to ensure separation of aircraft and timely and accurate provision of weather, NOTAM and other safety information;
f. standard runway and airport configurations, obstruction clearance, surrounding terrain, and other characteristics typical of major facilities serving scheduled international operations;
g. routine low visibility weather conditions (e.g. fog, precipitation, haze, wind components) which do not require special consideration; and
h. availability of alternate courses of action in the event of emergency situations.

5.2.3.1 Unless otherwise differently specified by the authority[2], following take-off minima shall be used by the operators as minimum:

Table 5-2. Take-off minima

Type of Aircraft	No. of aircraft engine	RVR/VIS
Jet Engine Aircraft	Multi-engine	800 m
	Single engine	1600 m
Turboprop Aircraft	3-4 engine	800 m
	1-2 engine	1600 m

[2]In case of aerodrome in foreign land, the authority is the CAA of State of Aerodrome; otherwise, it is CAAN.

5.2.3 Take-off minima, which are relevant to the take-off manoeuvre itself, shall not be confused with weather minima required for flight initiation. For flight initiation, departure weather minima at an aerodrome shall not be less than the applicable minima for landing at that aerodrome unless a suitable take-off alternate aerodrome is available. The take-off alternate aerodrome shall be located within the following distances of the aerodrome of departure:

a. aeroplanes with two engines: one hour of flight time at a one-engine-inoperative cruising speed, determined from the aircraft operating manual, calculated in ISA and still-air conditions using the actual take-off mass; or
b. aeroplanes with three or more engines: two hours of flight time at an all-engines operating cruising speed, determined from the aircraft operating manual, calculated in ISA and still-air conditions using the actual take-off mass.

Note: Refer to Appendix B for a table of alternate aerodrome minima values.

5.3 NON-PRECISION APPROACH AND LANDING OPERATIONS

5.3.1 In VOR, LOC, NDB or RNAV without approved vertical guidance approach procedures, track guidance is provided, but vertical path information is not typically available unless the VNAV function of the FMS is used as advisory information.

5.3.2 The errors in position that may occur at MDA/H may be larger than those that would occur in an ILS/MLS/GLS approach procedure due to the characteristics of the track guidance and the selected rate of descent. This results in generally higher operating minima for non-precision approach and landing operations than for precision approach and landing operations.

5.3.3 The height element of approach minima for non-precision approach and landing operations

5.3.3.1 The height element in the minima of a VOR, LOC, NDB or an RNAV approach procedure designed without vertical guidance is the MDA/H. It is the altitude/height below which the aeroplane shall not descend unless the runway environment, i.e. the runway threshold, touchdown area, elements of the approach lighting or markings identifiable with the runway, is in sight and the aeroplane is in a position for a normal visual descent to land.

5.3.3.2 The MDA/H is based upon the OCA/H. It may be higher than, but shall never be lower than the OCA/H for the associated category of aircraft or system minima as prescribed in Appendix D, whichever higher. The method of determining the OCA/H is given in PANS-OPS (Doc 8168), Volume II.

5.3.4 The visibility element of approach minima for non-precision approach and landing operations

5.3.4.1 The minimum visibility required for the pilot to establish visual reference in time to descend safely from the MDA/H and continue to land will vary with:

- the aeroplane category,
- the MDA/H,
- the facilities available,

whether a straight-in or circling approach is used and whether the approach procedure is flown utilizing a CDFA technique or flown with a level flight segment at MDA.

5.3.4.2 In general, the minimum visibility required will be less for:

a) approach procedures flown utilizing a CDFA technique;
   1. RNAV with LNAV only.
   2. RNAV with LNAV/VNAV or LPV.

b) aeroplanes having slow approach speeds;

c) lower MDA/H; and

d) better visual aids.

5.3.4.3 The application of these criteria results in visibility minima for non-precision approach andlanding operations varying from 5 km to 750 m which shall be selected from Table 5-1 for the associated band of DH/MDH.

5.3.5 Circling approach minima

5.3.5.1 The MDA/H for a visual circling approach is based on the highest OCH for a specified category of aeroplane promulgated for the final and missed approach used to enter into the circling area and the OCH of the circling area itself. The minimum visibility for a circling approach shall be that associated with the applicable category of aircraft as shown in Table 5-3.

Table 5-3. Minimum visibility, maximum IAS and lowest MDH for circling versus aeroplane category

	Aeroplane Category			
	A	**B**	**C**	**D**
Max IAS (kt)	100	135	180	205
MDH (ft)	400	500	600	700
Minimum Meteorological Visibility (m)	1500	1600	2400	3600

Notes.—

1. *Minimum descent height (MDH). The MDH for circling shall be the higher of:*
   — the published circling OCH for the aeroplane category; or
   — the minimum circling height derived from Table 5-3; or
   — the DH/MDH of the preceding instrument approach procedure.
2. *The MDA for circling shall be calculated by adding the published aerodrome elevation to the MDH, as determined by 1 above.*
3. *Visibility. The minimum visibility for circling shall be the higher of:*
   — the circling visibility for the aeroplane category, if published; or
   — the minimum visibility derived from Table 5-3; or
   — the RVR minima for the preceding instrument approach procedure.

5.4 CATEGORY I OPERATIONS

5.4.1 A Category I operation has, in the past, been regarded as an approach operation using ILS, MLS or precision approach radar (PAR) with minima in the range of 300 to 200 ft DA/H and associated minimum visibilities ranging from 1 200 to 550 m. Currently, any precision approach and landing operation with a DA/H of 200 ft or higher and with a minimum visibility of 550 m RVR or greater willbe termed a Standard Category I operation.

5.4.2 Decision altitude/height

5.4.2.1 The DA/H for a precision approach and landing operation shall not be lower than:

a. the minimum height stated in the aeroplane airworthiness certification or operating requirements to which the aeroplane can be flown solely by reference to instruments;

b. the minimum height to which the approach aid or position-fixing system may be used solely by reference to instruments (refer to Appendix D for minimum heights for different systems);

c. the OCH; or

d. the DA/H to which the flight crew is permitted to operate.

5.4.2.2 A DA/H higher than the minimum stated above may be established where abnormal conditions prevail or are likely to been countered. The following paragraphs discuss some of the effects on DA/H of aeroplane geometry, aeroplane performance, offset final approach course and atmospheric turbulence.

5.4.2.3 In cases where the ILS/MLS reference datum height is less than the recommended 15 m (50 ft), it may be necessary to adjust visibility/RVR minima and ensure that flight crews are trained to provide adequate wheel clearance over the threshold. Where there is a displaced threshold or there is adequate under-run of sufficient strength available, there is no need for additional visibility/RVR.

5.4.2.4 An increase in DA/H may be required when an approach is carried out with an engine inoperative as the greater than normal height loss is likely to occur at the initiation of a go-around. DA/H in this case shall not be lower than any height mentioned in the AFM or equivalent document for such situation.

5.4.2.5 When using an offset final approach course, the aeroplane will be displaced laterally from the extended runway centre line. Therefore, the DA/H is to be set high enough to permit a visual lateral alignment manoeuvre to be completed before reaching the landing threshold. Additional altitude will need to be added to the approach minima to allow for this manoeuvre.

5.4.2.6 A DA/H higher than the minimum may also be established where it is known that abnormal flight conditions are likely to be met. PANS-OPS, Volume II, advises to increase the MOC by as much as 100 per cent in areas of mountainous terrain where adverse meteorological effects may exist. The increase of the MOC will also result in an increase of the OCH, which is the basis for the calculation of the DA/H and the visibility/RVR minima.

5.4.3 Runway visual range/visibility

5.4.3.1 The minimum weather conditions in which the pilot is considered to have the visual references required at and below DA/H shall be specified either as an RVR or as a visibility. However, these are values measured on the ground and not one or a combination of them can indicate with accuracy whether or not the pilot will have the required visual reference when reaching DA/H, due to a numberof factors. For example,

a. RVR is measured horizontally at the runway, but the pilot will normally be looking along a slant path at approach lights from a position some distance from the runway.

b. If the visibility is reduced by fog, it is likely that it will be less dense at ground level than above ground level, and slant visibility will probably be less than the horizontal visibility at ground level.

c. There may be cases, such as in shallow fog, where the slant visual range is greater than horizontal visibility during the earlier phases of an approach.

5.4.3.2 In general, there is a difference between a measured visibility and the RVR. Part of the transmissometer's measurement is the effect of the lighting setting and the background luminance, which is not the case when a visibility is reported. The effect of these differences is tabulated and explained in Appendix C.

5.4.3.3 A measurement of cloud base may not provide an accurate indication of the height at which a pilot will
acquire visual contact with the ground for a number of reasons:

a) the measurement is unlikely to be taken underneath the position of the glide path where the pilot establishes visual contact;

b) the cloud base may be uneven;

c) the position on the glide path may coincide with a break in the clouds; and

d) the distance that a pilot can see while still in cloud will vary with the thickness of the cloud and the visibility below the cloud.

5.4.3.4 The distance that a pilot needs to be able to see in order to have an adequate visual reference in sight at and below DA/H depends on:

- the eye position in space relative to the visual aids on the ground,
- the extent to which the view forward and downward is restricted by the aeroplane structure, and
- the type of visual aids.

5.4.3.5 With a higher DA/H and larger aeroplane, the pilot's eyes will be higher above the ground, and greater visibility will be required to achieve an acceptable visual segment; conversely, a better downward view over the nose and longer approach lighting system will require less visibility.

5.4.3.6 The minimum RVR for a Category I operation by large aeroplanes using automatic equipment will be the same as for small to medium-sized aeroplanes that are flown manually. A greater RVR may be required for manual operation of large aeroplanes with high approach speeds.

5.4.3.7 The length and character of the approach lighting will have a significant effect on the visibility minima. For example, at a height of 200 ft on a three-degree glide slope, the touchdown zone is about 1 100 m ahead of the aeroplane. If there is no approach lighting, the required RVR would need to be greater than 1 200 m to give the pilot an adequate view of the touchdown zone. Conversely, with fullapproach, touchdown zone, runway threshold, edge, and centre line lighting, sufficient visual information may be available at and below DA/H with RVRs as low as 550 m to enable the pilot to continue the approach using a combination of instrument and visual information. Therefore, the RVR values as given in Table 5-1 take the length of the approach lighting system into account as part of the formula for the derivation of the RVR.

5.4.3.8 Table 5-1 contains the lowest straight-in approach minima which can be used for any instrument approach and landing operation other than CAT II or CAT III.

5.4.3.9 In order to qualify for the lowest allowable values of RVR detailed in Table 5-1, the instrument approach procedures shall meet at least the following facility requirements and associated conditions:

a. Instrument approaches procedures with a designated vertical profile which does not require a rate of descent greater than 1 000 feet per minute, unless other approach angles are approved by the authority, where the facilities are:
   i. ILS/MLS/GLS/PAR; or
   ii. RNAV with approved vertical guidance; and

   where the final approach track is offset by not more than 15 degrees for Category A and B aeroplanes or by not more than 5 degrees for Category C and D aeroplanes.

b. Instrument approach procedures flown using the CDFA technique with a nominal vertical profile which does not require a rate of descent greater than 1 000 feet per minute, unless other approach angles are approved by the authority, where the facilities are NDB, NDB/DME, VOR, VOR/DME, LOC, LOC/DME, VDF, SRA or RNAV/LNAV, with a final approach segment of at least 3 NM, which also fulfils the following criteria:
   i. the final approach track is offset by not more than 15 degrees for Category A and B aeroplanes or by not more than 5 degrees for Category C and D aeroplanes; and
   ii. the FAF or another appropriate fix where descent is initiated is available, or distance to THR is available by FMS/RNAV or DME; and
   iii. if the MAPt is determined by timing, the distance from FAF to THR is < 8 NM.

5.4.3.10 An RVR as low as 550 m as indicated in Table 5-1 can be used for:

a. Category I operations to runways with FALS, runway touchdown zone lights (RTZL)and runway centre line lights (RCLL); or
b. Category I operations to runways without RTZL and RCLL when using an approved HUDLS, or equivalent approved system, or when conducting a coupled approach or flight-director- flown approach to the DH; or
c. RNAV with approved vertical guidance approach procedures to runways with FALS, RTZL and RCLL when using an approved HUD.

5.4.3.11 Values in Table 5-1 exceeding 1 500 meters (Category A and B aircraft) or 2 400 meters (Category C and D aircraft) do not have to be applied if the approach operation is based on:

a. ILS, MLS, GLS, PAR and RNAV with approved vertical guidance; or
b. NDB, NDB/DME, VOR, VOR/DME, LOC, LOC/DME, VDF, SRA and RNAV without approved vertical guidance but fulfilling the criteria in para 5.4.3.13.

5.4.3.12 Values in Table 5-1 which are less than 1 000 meters may not be applied if the approach operation is based on NDB, NDB/DME, VOR, VOR/DME, LOC, LOC/DME, VDF, SRA and RNAV without approved vertical guidance if:

a. the criteria in para 5.4.3.13are not fulfilled; or
b. the DH or MDH is 1 200 ft or higher.

5.4.3.13 Enhanced vision systems

An enhanced vision system (EVS) assists the pilot in the transfer from the instrument to the visual phase of flight through an enhancement of visual references using imaging sensors. As such, the visibility credit for EVS systems is provided while establishing the minima. When considering EVS visibility credit:

a) approach alignment should allow a sufficient view of the runway when using EVS equipment;
b) vertical guidance from either an ILS/MLS/GLS or through the use of a CDFA technique should be considered if available; and
c) visual descent points and published minimum altitudes of step-down fixes should beemphasized to ensure clearance of obstacles which may not be visible when using imaging sensors.

Appendix E contains visibility credits about RVR values that can be used when using enhanced vision systems.

5.5 CATEGORY II OPERATIONS

5.5.1 Category II operations are made to a DA/H below 200 ft, but not lower than 100 ft, with associated RVRs ranging from 550 m to 300 m. To obtain the maximum benefit from improvements in ground facilities, it is important to consider all the factors that might enable a safe reduction in minima (the use of automatic approach equipment in the aeroplane, a suitable head-up display, etc.). The factors considered in 5.4 for Category I operations are generally applicable to Category II operations also.

5.5.2 Decision height

The DH specified for a Category II operation will normally be the OCH promulgated for the procedure but will not be less than 100 ft. Three methods for calculating the OCH are given in PANS-OPS (Doc 8168), Volume II. If an aerodrome is in an area with many obstacles, the use of the ICAO collision risk model (CRM) will facilitate obstacle assessment. Except in unusual circumstances, such as with irregular underlying terrain, DHs are based on radio altimeter information.

5.5.3 Runway visual range/visibility

5.5.3.1 The RVRs specified for Category II operations consider that the first visual contact typically is made with the approach lighting system and that by the time the aeroplane has descended to 50 ft., the TDZshould clearly be in view. Although manual Category II operations may be authorized, Category II operations are normally carried out coupled. In addition, some large aeroplanes may use automatic landing system or approved head-up display landing system during touchdown.

5.5.3.2 Visibility minima for Category II operations are specified in terms of RVR. Thus, an RVR assessment system is a requirement for a runway used for Category II operations.

5.5.3.3 In the case of a CAT II operation, a pilot shall not continue an approach below the Category II DHunless visual reference containing a segment of at least three consecutive lights that depict the centre line of the approach lights or touchdown zone lights or runway centre line lights or runway edge lights or a combination of these is attained and can be maintained. This visual reference shall include a lateral element of the ground pattern, i.e. an approach lighting crossbar or the landing threshold or a barrette of the touchdown zone lighting, unless the operation is conducted utilizing an approved HUDLS to touchdown.

5.5.4 Approach minima

The DA/H for a Category II operation shall be the OCH or the DA/H authorized for the aircraft or the crew and shall not be less than 100 ft. The RVR minimum of 300 m is applicable to Category II operations. However, larger aeroplanes may necessitate a greater RVR, unless use is made of an auto- land system, thus making use of aircraft capabilities to increase safety. Similarly, if it is necessary to increase DA/H due to, for example, facility limitations or an increased OCH, then a corresponding increase in minimum RVR will be required as shown in Table 5-4. Standard visual aids appropriate to the category of operation shall be provided.

Table 5-4. Category II Operations Minima

DH	Category II operations minima coupled to below DH[1]	
	RVR/Aeroplane Category A, B and C	RVR/Aeroplane Category D
100 ft – 120 ft	300 m	300 m[2]/350 m
121 ft – 140 ft	400 m	400 m
141 ft – 199 ft	450 m	450 m

1. The reference to "Coupled to below DH" in this table means continued use of the automatic flight control system down to a height which is not greater than 80 per cent of the applicable DH. Thus, airworthiness requirements may, through minimum engagement height for the automatic flight control system, affect the DH to be applied.
2. For a CAT D aeroplane conducting an auto-land, 300 m may be used.

5.6 CATEGORY III OPERATIONS

5.6.1 For Category III minima, a fail-operational flight control system ensures that the pilot is extremely unlikely to have to revert to manual control of the aeroplane because of a system failure in the Category III regime. If the flight control system is fail-passive in operation, then consideration should be given to the ability of the pilot to continue safely with the landing or to carry out a missed approach manually. In Category III operations, the entire approach down to the touchdown should be flown automatically except for those systems approved for manual control based on the use of head- up displays.

5.6.2 In Category III operations, the need for specific minima in the form of visual reference or DH requirements is determined by the reliability of the automatic systems. Where such minima are necessary, they will depend on the visual segment required, the pilot's field of view and the probability of the automatic system failing.

5.6.3 Category III operations are subdivided as Category IIIA, Category IIIB and Category IIIC. The provisions for Category IIIA operations are presented in the following paragraphs.

5.6.4 Category IIIA operations

5.6.4.1 Decision height

5.6.4.1.1 CAT III A operations require the specification of a DH below 100 ft or no DH.

5.6.4.1.2 The obstacle environment in the final segment of the approach requires permitting an aeroplane, coupled to the ILS by an automatic flight control system, to fly safely without visual reference to the ground, down to the TDZ where there is no DH and carryout a missed approach when required. In Category IIIA operations, as in other operations, the aeroplane shall be capable of executing a missed approach from any height prior to touchdown.

5.6.4.1.3 In Category IIIA operations where DHs are used, their purpose is to specify the lowest height at which a pilot should be assured that an aeroplane is being satisfactorily delivered to the runway and that adequate visual reference is available for control of the initial part of the landing roll.

5.6.4.2 Runway visual range

5.6.4.2.1 For Category IIIA operations (ground roll to be manually controlled using visual reference), a minimum RVR of 175 m will be required.

5.6.4.2.2 For Category IIIA operations, a pilot may not continue an approach below the DH unless a visual reference containing a segment of at least three consecutive lights that depict the centre line of the approach lights or touchdown zone lights or runway centre line lights or runway edge lights or a combination of these is attained and can be maintained.

5.6.4.3 Operating minima

5.6.4.3.1 The lighting system required for supporting Category IIIA operations with the RVR value shown in Table 5-5 includes approach, runway edge, threshold, centerline and touchdown zone lighting.

Table 5-5 Category IIIA operations minima

Category	Decision Height	Roll-out control/guidance	RVR
IIIA	Less than 100 ft	Not required	175 m

5.6.4.3.2 Decision height. For operations in which a DH is used, an operator shall ensure that the decision height is not lower than:

a) the minimum DH specified in the AFM, if stated;

b) the minimum height to which the precision approach aid can be used without the required visual reference; and

c) the DH to which the flight crew is authorized to operate.

5.6.4.3.3 No decision height. For operations with no DH, an operator shall ensure that the operation is conducted only if:

a) the operation with no DH is authorized in the AFM;

b) the approach aid and the aerodrome facilities can support operations with no DH; and

c) the operator has an approval for CAT IIIA operations with no DH.

Note.— In the case of a CAT IIIA runway, the operations with no DH can be supported unless specifically restricted the State AIP or NOTAM.

5.6.5 CATEGORY III B AND CATEGORY III C OPERATIONS

To be developed.

Appendix A

APPROACH LIGHTING SYSTEMS

The length and shape of the approach lights play an essential role in the determination of the landing minima. Shorter approach lighting systems require greater RVR. Therefore, the length of the approach lights is directly correlated with the RVR/VIS. Approach lighting system configurations are described in Table B below where the visibility values are based on the availability of the indicated facilities.

Table A. Approach Lighting Systems

Class of facility	Length, configuration and intensity of approach lights
FALS (Full Approach Lighting System)	Precision approach CAT I lighting system (HIALS ≥ 720 m)
IALS (Intermediate Approach Lighting System)	Simple approach lighting system (HIALS 420 m to 719 m)
BALS (Basic Approach Lighting System)	Any other approach lighting system (HIALS, MIALS or ALS 210 m to 419 m)
NALS (No Approach Lighting System)	Any other approach lighting system (HIALS, MIALS or ALS< 210 m), or No approach lights

Appendix B

ALTERNATE AERODROME MINIMA

The guidelines for the development of alternate minima by the operators are provided in the Table B below.

Table B. Alternate Aerodrome Operating Minima

Approach facility configuration	Ceiling DA/H or MDA/H	RVR
For airports supporting one approach and landing operation	Authorized DA/H or MDA/H plus an increment of 400 ft	Authorized visibility plus an increment of 1 500 m
For airports supporting at least two approach and landing operations, each providing a straight-in approach and landing operation to different, suitable runways	Authorized DA/H or MDA/H plus an increment of 200 ft	Authorized visibility plus an increment of 800 m
For airports with a published CAT II or CAT III approach and landing operation, and at least two approach and landing operations, each providing a straight-in approach and landing operation to different, suitable runways	CAT II procedures, a ceiling of at least 300 ft, or for CAT III procedures, a ceiling of at least 200 ft	CAT II, a visibility of at least RVR 1 200 m or, for CAT III, a visibility of at least RVR 550 m

Appendix C

CONVERSION OF REPORTED METEOROLOGICAL VISIBILITY (RVR/CMV) PRACTICES FOR THE APPLICATION OF AN APPROACH BAN

1. The principle of converting reported meteorological visibilities into corresponding RVR values and the exclusive use of either reported or converted RVR values for the determination of straight-in approach minima had first been introduced in 1995 by Europe's Joint Aviation Authorities (JAA) and this JAA AOM concept was not only adopted by all European States but also found having widespread acceptance by many other States outside Europe and many airline operators worldwide.

2. The evolution of a new AOM concept, based on CDFA, made it necessary to develop a new term for reported meteorological visibilities converted into RVRs when these values exceed 2 000 m because upper RVR values defined for straight-in approaches in the new AOM concept do not end at 2 000 m but at 5000 m. The new term found was "converted meteorological visibility" (CMV). CMV values are derived by applying the same methodology as applied for the conversion of reported meteorological visibilities into RVR values in those cases where the resulting values exceed 2 000 m.

3. Because runway visual range and meteorological visibility are established differently, a ratio can be established between the two. The effect of lighting intensities and background luminance playsa role when establishing a runway visual range. Table C indicates the relation between light intensity and day or night conditions.

Table C. Conversion of meteorological visibility to RVR/CMV

Lighting elements in Operation	RVR/CMV = Reported Meteorological Visibility multiplied by:	
	Day	Night
High intensity approach and runway lighting	1.5	2.0
Any type of lighting installation other than above	1.0	1.5
No lighting	1.0	Not applicable

4. An operator must ensure that a meteorological visibility to RVR/CMV conversion is not used for take-off, for calculating any other required RVR minimum less than 800 m or when reported RVR is available.

5. When converting meteorological visibility to RVR in all other circumstances than those in 4 above, an operator must ensure that Table C is used.

Appendix D

SYSTEM MINIMA FOR APPROACH AND LANDING OPERATIONS

The DA/H or MDA/H for a particular operation shall be the OCH (for the non-precision approach procedure) or the minimum height authorized for the aeroplane and the crew or the system minima of Table D-1, whichever is the highest. The minimum RVR to be associated with this DA/H or MDA/H can be determined from Table D-2 and Table 5-1.

Table D -1. System Minima versus Instrument Approach Procedures

Instrument Approach Procedure	Lowest DH/MDH
ILS/MLS/GLS Cat I	200 ft[1]
RNAV with approved vertical guidance	250 ft
Localizer with or without DME	250 ft
SRA (terminating at ½ nm)	250 ft
SRA (terminating at 1 nm)	300 ft
SRA (terminating at 2 nm)	350 ft
RNAV without approved vertical guidance	300 ft
VOR	300 ft
VOR/DME	250 ft
NDB	350 ft
NDB/DME	300 ft
VDF	350 ft

[1]. The lowest authorized DH for Category I operations is 200 ft unless an equivalent level of safety can be achieved through use of additional procedural or operational requirements.

Table D-2. Minimum and Maximum RVR/VIS for Instrument Approaches down to CAT I Minima

Facility/conditions	RVR/VIS (m)	Aeroplane category			
		A	B	C	D
ILS/MLS/GLS, PAR and RNAV with approved vertical guidance	Min	According to Table 5 -1			
	Max	1500	1500	2400	2400
NDB, NDB/DME, VOR, VOR/DME,LOC,LOC/DME, VDF, SRA and RNAV without approved vertical guidance with a procedure which fulfils the criteria in para 5.4.3.9.	Min	1 750	750 1	1 750	1750
	Max	1 500	1 500	2 400	2 400
For NDB, NDB/DME, VOR, VOR/DME, LOC, LOC/DME, VDF, SRA and RNAV without approved vertical guidance: — not fulfilling the criteria in para 5.4.3.13; or — with a DH or MDH ≥ 1 200 ft.	Min	1 000	1 000	1 200	1 200
	Max	According to Table 5-1, if flown using the CDFA technique, otherwise an add-on of 200/400 m applies to the values in Table 5 -1 but not to result in a value exceeding 5 000 m.			

Appendix E

VISIBILITY CREDIT FOR ENHANCED VISION SYSTEMS

1. A pilot using an appropriately certificated Enhanced Vision System (EVS) in accordance with the procedures and limitations of the approved flight manual may:
   a) continue an approach below DH or MDH to 100 ft above the threshold elevation of the runway provided that at least one of the following visual references is displayed and identifiable on the EVS:
      i. elements of the approach lighting; or
      ii. the runway threshold, identified by at least one of the following:
         - the beginning of the runway landing surface,
         - the threshold lights,
         - the threshold identification lights; and
         - the touchdown zone, identified by at least one of the following:
            - the runway touchdown zone landing surface,
            - the touchdown zone lights,
            - the touchdown zone markings or
            - the runway lights.

   b) reduce the calculated RVR for the approach from the value in column 1 to the value in column 2 of Table E.

2. Paragraph 1 shall be used for ILS, MLS, PAR, GLS and RNAV with approved vertical guidance approach procedures with a DH no lower than 200 ft or an approach flown using approved vertical flight path guidance to an MDH or DH no lower than 250 ft.

3. A pilot shall not continue an approach below 100 ft above runway threshold elevation for the intended runway unless at least one of the visual references specified below is distinctly visible and identifiable to the pilot without reliance on the EVS:
   a) the lights or markings of the threshold; or
   b) the lights or markings of the touchdown zone.

Table E. Approach using EVS RVR Reduction Versus Normal RVR

RVR normally required (Col. 1)	RVR for approach utilizing EVS (Col. 2)		RVR normally required (Col. 1)	RVR for approach utilizing EVS (Col. 2)
550	350		2 700	1 800
600	400		2 800	1 900
650	450		2 900	1 900
700	450		3 000	2 000
750	500		3 100	2 000
800	550		3 200	2 100
1 900	600		3 300	2 200
1 000	650		3 400	2 200
1 100	750		3 500	2 300
1 200	800		3 600	2 400
1 300	900		3 700	2 400
1400	900		3 800	2 500
1 500	1 000		3 900	2 600

1 600	1 100		4 000	2 600
1 700	1 100		4 100	2 700
1 800	1 200		4 200	2 800
1 900	1 300		4 300	2 800
2 000	1 300		4 400	2 900
2 100	1 400		4 500	3 000
2 200	1 500		4 600	3 000
2 300	1 500		4 700	3 100
2 400	1 600		4 800	3 200
2 500	1 700		4 900	3 200
2 600	1 700		5 000	3 300

Appendix F

CHECKLIST FOR APPROVING THE OPERATOR'S METHODOLOGY FOR DETERMINATION OF AOM

Name of Operator: …………………………………………………

Address: …………………………………………………………………

(**A** = Acceptable, **U** = Unacceptable, **N/A** = Not Applicable)

Doc. Ref.	Requirements	A	U	N/A	Observations, if any
AOCR 2.1.2/ FOR 4.2.8	Documented methods or procedures as part of OM developed for determining aerodrome operating minima.				
AOCR 2.1.2/ FOR 4.2.8	Documented evidence of Aerodrome Operating Minima for every airport to which the operator intends to fly to as destination or alternate.				
MFDA AOM/ Table 5-1, 5-2, 5-3, 5-4, 5-5, B, C, D-1, D-2, E	Minima values complies the regulatory provision: a. Approach and Landing Minima • NPA, APV, PA CAT I • PA CAT II • PA CAT IIIA b. Take-off Minima				
MFDA AOM/ Chap. 4, Para 4.2, 4.4	Aircraft and aircrew qualification to conduct desired operations				
MFDA AOM/ Chap. 5, Para 5.1.8.8	Application of increased aerodrome operating minima with justification				
MFDA AOM/ Chap. 5, Para 5.4.3.13	Application of reduced aerodrome operating minima with justification				

COMMENTS:

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FOI

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Signature & Date

VERIFIED BY:

____
Chief (Flight Operations)

____
Signature & Date

Appendix G

RESPONSIBILITIES OF AIRLINE OPERATORS

The operators shall be responsible for AOM and the associated tasks to as mentioned below:

a. Establishing the AOM for the use of approved runways, including classification of aerodromes and the related qualification requirements; to be done within the regulatory framework.

b. Monitoring aerodrome changes, via NOTAM, which affect operations that have been approved by regulation.

c. Ensuring proper training and certification of airmen for all-weather operations or limited visibility operations.

d. Ensuring that all approved operators have proper methods or systems to disseminate updated LVP information where so developed by the aerodrome.

[END]