
ADVISORY CIRCULAR

SUBJECT: AERODROME LOW VISIBILITY OPERATIONS – ILS CAT II	DATE: 2016-08-10	AC NUMBER: 139-03	VERSION: 1.0
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NOTE: THIS ADVISORY CIRCULAR IS PUBLISHED TO PROVIDE REGULATORY INFORMATION AND DESCRIBE ACCEPTABLE MEANS OF COMPLIANCE WITH THE GENERAL AUTHORITY OF CIVIL AVIATION REGULATIONS (GACAR).

CHAPTER 1 – INTRODUCTION

1.1 Purpose.

This advisory circular (AC) provides information to aerodrome operators and other affected stakeholders on the requirements to be met to conduct low visibility operations supporting the conduct of ILS Category II instrument approach procedures and low visibility takeoff (LVTO) operations. It provides information on acceptable means of compliance with regulatory requirements related to implementing ILS Category II instrument approach and landing operations at an aerodrome. This information in this AC is additional or supplementary to the requirements for ILS Category I operations, or Lower Than Standard (LTS) Category I operations.

1.2 Applicability.

This advisory circular is applicable to any aerodrome in the Kingdom of Saudi Arabia (KSA) that intends to support ILS Category II instrument approach and landing operations.

1.3 Cancellation.

This is the first official version of this advisory circular and it cancels no other advisory circulars.

1.4 Related Regulatory Provisions.

GACAR Parts 1, 5, 139, 171, 172, 172 and 173.

1.5 Related Reading Material and Forms.

The following documents, *inter alia*, are relevant to the aerodrome requirements necessary to support ILS CAT II operations:

(a) ICAO Annex 10 – Aeronautical Telecommunications;

- (b) ICAO Annex 14 – Aerodromes;
- (c) ICAO Annex 15 – Aeronautical Information Services;
- (d) ICAO Annex 19 – Safety Management;
- (e) ICAO Doc 8168 – PANS-OPS Volumes I and II;
- (f) ICAO Doc 9137 – Airport Services Manual;
- (g) ICAO Doc 9157 – Aerodrome Design Manual;
- (h) ICAO Doc 9184 – Airport Planning Manual;
- (i) ICAO Doc 9365 – Manual of All Weather Operations;
- (j) ICAO Doc 9774 – Manual on Certification of Aerodromes;
- (k) ICAO Doc 9859 – Safety Management Manual;
- (l) ICAO Doc 9426 - Air Traffic Services Planning Manual;
- (m) ICAO Doc 9476 – Manual on Surface Movement Guidance and Control Systems (SMGCS);
- (n) ICAO Doc 9830 – A-SMGCS Manual;
- (o) ICAO Doc 9859 – Safety Management Manual;
- (p) ICAO Doc 9981 – PANS – Aerodromes;
- (q) KSA Aeronautical Information Publication (AIP) and associated documents.

NOTE: References to specific sections or paragraphs of the above documents in this AC are valid for the versions of these documents in effect on the date of publication of this AC.

1.6 Definitions of Terms Used in this Advisory Circular.

Affected parties should refer to Subpart A of GACAR Part 1 for a full listing of defined terms used in the new GACAR and specifically those related to safety management. This advisory circular may introduce several additional definitions to aid in a common understanding of the ideas presented in this document. In cases where the definitions in this document differ from an identical term

defined in GACAR Part 1, the definition in GACAR Part 1 will prevail when interpreting regulatory requirements.

1.7 Approval.

This advisory circular has been approved for publication by the Assistant President, Safety, Security and Air Transport Sector of the General Authority of Civil Aviation.

CHAPTER 2 – GENERAL PROVISIONS

2.1 As a condition of aerodrome certification, the aerodrome operator is responsible for developing, establishing and maintaining Low Visibility Procedures (LVP). LVP are developed in conjunction with ATC and other affected parties including the meteorological service, and the navigation facility maintenance organization.

2.2 When upgrading and maintaining the facilities used to support aerodrome surface or flight operations taking place when Reduced Aerodrome Visibility Conditions (RAVC) exist, or to support flight operations which require LVP to be in force, the aerodrome operator must, under the provisions of GACAR Part 139, take into account the Standards and Recommended Practices (SARPS) detailed in Annex 14.

2.3 The aerodrome operator should establish operational procedures to support the LVP Preparation Phase. The activation of the LVP Preparation Phase is initiated by ATC when it is assessed that LVP are likely to be required. The coordination of activities undertaken as part of safeguarding the movement area would be the responsibility of the aerodrome operator. It is the responsibility of the aerodrome operator to ensure that all required operational measures are in place before advising ATC that LVP can be declared to be in force.

2.4 This advisory circular outlines the prerequisites to be considered in the development and implementation of infrastructure, facilities, equipment and procedures that will be used to support the ground operation of aircraft & vehicles on the aerodrome when RAVC exist, as well as the requirements to support specified take-off and departure and approach and landing operations that require LVP to be in force.

2.5. The aerodrome operator should establish operational procedures for maintenance and inspection of electrical system related to ILS equipment, as per ICAO Annex 14, Chapter 10, PANS-AERODROMES (Doc 9981) Annex 1 to Chapter 2 and ICAO Doc 9137, Part 9. The Aerodrome Manual should be updated accordingly (PANS-AERODROMES, Appendix C to Chapter 2)

2.6. The aerodrome operator should establish operational procedures for maintenance and inspection of ILS equipment, as per ICAO Annex 14, Chapter 10, PAN-AERODROMES, Annex 1 to Chapter 2 and ICAO Doc 9137, Part 9. The Aerodrome Manual should be updated accordingly.

2.7. When safety occurrences of the following types are reported, the following critical data should be collected when relevant and feasible. This may require a collaborative effort from the aerodrome operator, air navigation service provider or other involved parties commensurate with the severity

of the potential risk attached to each occurrence: Ground-based vertical guidance available and operational, mainly for instrument landing system (ILS), precision approach path indicator (PAPI), abbreviated precision approach path indicator (APAPI);

2.8 When considering the equipment requirements and the operations that take place on the aerodrome, it is important to appreciate the relationship between the existing provisions developed by the various agencies involved in the process.

2.9 The specific equipment and operational procedures which need to be provided for the safe conduct of these ground operations depends on the aerodrome operating minima chosen and the extent to which aircraft and vehicles may come into conflict. Conflicting traffic may be reduced or eliminated by restricting the number and type of movements and selection of facilities appropriate for the particular aerodrome lay-out and traffic density planned. The means adopted will vary with the size and complexity of the maneuvering area and with the movement rate required.

2.10 The ICAO Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) details operational requirements for basic surface movement guidance and control systems. The systems described in ICAO Doc 9476 are not always capable of providing the support to aircraft operations as necessary to enable the required levels of capacity and safety, especially under low visibility conditions.

2.11 The ICAO Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830) provides additional guidance intended to support the provision of adequate capacity and safety in relation to specific weather conditions, traffic density and aerodrome layout by making use of modern technologies and a high level of integration between the various functionalities.

2.12 This advisory circular outlines the aerodrome facilities and infrastructure necessary to support aerodrome ground and aircraft operations for Low Visibility Operations - ILS Category II (ILS CAT II). To achieve certification for ILS CAT II operations, aerodrome operators must comply fully with the requirements of GACAR Part 139, ICAO Annex 14 and associated documents.

2.13 When aircraft or aerodrome ground operations are planned to take place while Reduced Aerodrome Visibility Conditions (RAVC) exist, all the facilities of the aerodrome must be considered and assessed for their suitability for such operations. Special operational procedures, and, in some instances, additional equipment, may be required to ensure that these operations can be conducted safely.

CHAPTER 3 – REQUIREMENTS FOR AERODROME OPERATORS

3.1 Physical Characteristics.

3.1.1 The physical characteristics of the runways and taxiways, as well as the requirements for obstacle clearance, the protection of the defined areas surrounding a runway, and the characteristics of pre-threshold terrain need to be carefully considered in order to ensure that low visibility departure and approach operations can be conducted safely. Full design requirements can be found in Annex 14 Volume I, and ICAO Doc 9157, Parts 1 and 2.

Longitudinal Slopes

3.1.2 The longitudinal slopes of the runway should not exceed 0.8 per cent for the first and last quarter of the length of the runway. (Refer ICAO Annex 14, Volume I, para 3.1.14).

Obstacle Limitation Requirements.

3.1.3 The following obstacle limitation surfaces must be established for a precision approach runway:

- Conical surface;
- Inner horizontal surface;
- Approach surface and inner approach surface;
- Transitional surfaces;
- Inner transitional surfaces; and
- Baulked landing surface. (Refer ICAO Annex 14, Volume I, para 4.2.15).

3.1.4 The obstacle-free zone, extended to the appropriate Category II obstacle clearance height, must not be penetrated by any obstacle except those specifically permitted in Annex 14, Volume I.

Runway Centerline Marking

3.1.5 The width of the runway centerline stripes must not be less than 0.90 m. (Refer ICAO Annex 14, Volume I, para 5.2.3.4).

Taxiway Centerline Marking

3.1.6 If the enhanced taxiway centerline marking intersects another runway-holding position marking, such as for a precision approach ILS CAT II or III runway, and it is located within 47 m of the first runway-holding position marking, the enhanced taxiway centre line marking must be

interrupted 0.9 m prior to and after the intersected runway-holding position marking. (Refer ICAO Annex 14, Volume I, para 5.2.8).

3.2 Construction and maintenance activities.

3.2.1 Construction or maintenance activities in the proximity of aerodrome electrical systems must be restricted whenever low visibility procedures are in force. Details may be found in Annex 14, Volume I, 10.4.13.

3.3 ILS Equipment.

3.3.1 ILS equipment must comply with the requirements, and be installed in accordance with the requirements, of ICAO Annex 10, Volume I, Parts 2 and 3. Aerodrome operators must ensure that the organization responsible for the maintenance of the ILS equipment complies with all of the operational requirements for low visibility operations when those procedures are in force.

3.4 Secondary power supplies.

3.4.1 Requirements and recommendations for the provision of power supplies for aerodrome lighting and other essential facilities and equipment, including changeover times for secondary supplies, are specified in Annex 14, Volume I, 8.1.

3.4.2 Further guidance material is provided in the Aerodrome Design Manual (Doc 9157), Part 4.

3.4.3 Requirements and recommendations on how to achieve specified changeover times is contained in Annex 10, Volume I, Attachment C to Part I.

3.4.4 For Category II ILS operations, aerodromes must provide secondary power supplies in accordance with Annex 14, Volume I, 8.1. Maximum switch over times are outlined below and detailed at Annex 14, Volume I, Table 8-1.

Inner 300 m of the approach lighting	1 second
Other parts of the approach lighting	15 seconds
Obstacles	15 seconds
Runway edge	15 seconds
Runway threshold	1 second
Runway end	1 second
Runway centerline	1 second
Runway touchdown zone	1 second

All stop bars	1 second
Essential taxiway	15 seconds

3.5 Visual aids.

3.5.1 The need for visual aids will depend on the type of operations to be undertaken under various visibility conditions, the traffic density to be supported, and the complexity of the aerodrome layout and ground operations. The following information is provided in the context of ILS Cat II operations.

3.5.2 As visibility conditions deteriorate, appropriate visual aids may be required to enable pilots and vehicle drivers to identify their position and required routings on the movement area, and to assist them in avoiding other traffic.

3.5.3 Requirements and recommendations relating to visual aids at aerodromes are detailed at Annex 14, Volume I, Chapter 5.

3.5.4 Details of the taxiway guidance system must be published in the appropriate sections of the AIP. Requirements are shown in Annex 15, Appendix 1, AD 2.9.

Surface Movement Guidance and Control System

3.5.5 A surface movement guidance and control system must be provided at the aerodrome. Requirements are shown in Annex 14, Volume I, paragraph 9.8.1.

3.5.6 The design requirements for a surface movement guidance and control system are shown in Annex 14, Volume I, paragraph 9.8.2 and should take into account:

- The density of air traffic;
- The visibility conditions under which operations are intended;
- The need for pilot orientation;
- The complexity of the aerodrome layout;
- Movements of vehicles.

3.5.7 Aerodrome operators should consider providing location and guidance signs, markings and traffic lights on service roads.

Note.— Guidance on surface movement guidance and control systems is contained in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (ICAO Doc 9476).

3.6 Aerodrome markings.

3.6.1 General requirements and recommendations relating to aerodrome markings are specified in Annex 14, Volume I, 5.2.

3.6.2 Specific requirements relating to aerodrome marking topics items may be found in Annex 14, Volume I at the references noted in the table below:

Runway holding position marking	5.2.10
Aircraft stand markings	5.2.13
Safety lines on a paved apron	5.2.14
Aircraft stand maneuvering guidance lights	5.3.26
Continuous guidance (including aircraft stand lead in line and maneuvering guidance lights)	5.2.8
Runway holding positions installed for protection for relevant localizer and glidepath critical & sensitive areas and the obstacle free zone (OFZ)	5.2.11
Intermediate holding position markings at taxiway intersections and intermediate holding position markings	5.2.11
Runway centerline marking	5.2.3.1
Guided take-off	Table 3-2 plus Att C & G from Annex 10, Volume I
Threshold marking at the threshold of a paved instrument runway	5.2.4
Aiming point marking at each approach end of a paved runway	5.2.5.2 and 5.2.5.3
Touchdown zone markings on paved runways	5.2.6.1 and 5.2.6
Holding bay, runway-holding position and road-holding positions	Table 3-2 plus Att C & G from Annex 10, Volume I

3.6.3 In addition, it is recommended that:

- Surface markings that are the sole runway or taxiway center line reference to the users during low visibility procedures (LVP), or other essential markings used in connection with LVP, be

sufficiently conspicuous to the users throughout the taxi routes, and kept free of contamination;

- Service roads and emergency access roads are provided with adequate markings to enable drivers of emergency response vehicles to establish their position and route in the lowest visibility conditions in which the aerodrome maintains operations.

3.7 Lighting.

3.7.1 General requirements and recommendations relating to lighting systems are specified in Annex 14, Volume I, Chapter 5.3.

3.7.2 Specific requirements relating to lighting systems may be found may be found in Annex 14, Volume I at the references noted in the table below:

Automatic monitoring and relay to ATSU's of lighting systems that are used for aircraft control purposes	8.3.2
Runway edge lights provided for a runway intended for use at night	5.3.9.1
Automatic monitoring of lighting systems	8.3.4 and 8.3.5
Indication of the operational status of lights within defined response times.	8.3.3
Runway threshold identification lights	5.3.8.1
Runway edge lights on runways intended for take-off when RVR < 800m	5.3.9.2
Runway centerline lights on runway intended to be used for take-off	5.3.12.4
Runways to be equipped with edge lights with runway end lights	5.3.9.1 and 5.3.11.1
Runway edge lights spaced at intervals of not more than 60 m	5.3.9.6
Runway centerline lights on runways intended to be used when RVR < 400 m	5.3.12.3
Approach lighting systems	5.3.4
Runway edge lights uniformly spaced in rows - not more than 60 m intervals	5.3.9.1 and 5.3.9.6
Runway threshold lights spacing	5.3.10.1 and 5.3.10.4.b.
Configuration of runway threshold lights	5.3.10.1 and 5.3.10.4.b and 5.3.11.3.

Configuration of runway end lights	5.3.11.1 and 5.3.11.2 and 5.3.11.3.
Configuration of runway centerline lights	5.3.12.1 and 5.3.12.5
Provide runway touchdown zone lights	5.3.13
Provide taxiway center line lights for use when RVR < 350 m	5.3.16.1
Special design criteria relating to taxiway lighting highlighting ILS critical/sensitive areas and the transitional surfaces	5.3.16.7
Provision of rapid exit taxiway indicator lights (RETILs) on a runways intended for use when RVR < 350 m, and/or where the traffic density is heavy	5.3.14.1
Lighting for any intermediate holding position defined for use in visibility conditions corresponding to RVR below 350 m	5.3.20.1
Intermediate holding position lights	5.3.20.2
Lighting for road-holding positions serving a runway intended to be used when RVR < 350 m	5.3.27.1
Colors of aircraft stand maneuvering guidance lights	5.3.26
Effective guidance to aircraft maneuvering on the apron during all visibility conditions in which the aerodrome is used	5.3.25
Provision of aircraft stand maneuvering guidance lights for stands intended for use in poor visibility conditions	5.3.26
Spacing of runway lights to be published in the AIP	Annex 15, App 1, AD 2.14

3.7.3 Guidance on air traffic control interface and visual aids monitoring can be found in the Aerodrome Design Manual (ICAO Doc 9157), Part 5.

3.7.4 Runway lighting systems must be automatically monitored to provide an indication when the serviceability levels of any element, falls below the minimum serviceability level specified in Annex 14, Volume 1, 10.4.7 to 10.4.11. This information should be automatically relayed to the maintenance crew. (Refer Annex 14, Volume 1, 8.3.4).

3.7.5 Runway lighting systems must be automatically monitored to provide an indication when the serviceability level of any element falls below the minimum level below which operations should not continue. This information should be automatically relayed to the air traffic services unit and displayed in a prominent position. (Refer Annex 14, Volume I, 8.3.5).

3.7.6 Strobe Lighting (sequenced or not), if installed, should not be used when ILS CAT II operations are in progress.

3.7.7 Runways centerline lights located from the threshold to the end at longitudinal spacing of approximately 15 m. Where the serviceability level of the runway centerline lights specified as maintenance objectives in Annex 14, Volume 1, 10.4.7 or 10.4.11, as appropriate, can be demonstrated and the runway is intended for use in runway visual range conditions of 350 m or greater, the longitudinal spacing may be approximately 30 m. (refer Annex14, Volume I, 5.3.12.5).

3.7.8 Annex 14, Volume I, Figure 5-25 provides information on design and configuration of centerline lights on a rapid exit taxiway. Annex 14, Volume I, Appendix 2, Figures 2-12, 2-13 and 2-14 provides information for the design and configuration the centerline lighting for taxiways intended to be used for operations in visibility conditions corresponding to RVR of less than 350 m. 3.7.9 Guidance on the design of taxiways, including the cockpit centerline tracking technique, is given in the Aerodrome Design Manual, Part 2.

3.7.10 Standards relating to taxiway centerline lights on taxiways intended for use at night in runway visual range conditions of 350 m or greater, and particularly on complex taxiway intersections and exit taxiways, except that these lights need not be provided where the traffic density is light and taxiway edge lights and centre line marking provide adequate guidance are shown in Annex 14, Volume I, 5.3.16.2.

3.7.11 The following practices relating to taxiway lighting are recommended:

- a. Switchable or additional lighting may assist the correct identification of the nominated runway turn-off.
- b. To make best use of the capacity of a runway and to assist pilots in the assessment of their relative position along the runway, the conspicuity of the approach to a rapid exit taxiway should be enhanced.
- c. During LVP, the remaining distances to rapid exit taxiways should be identified by appropriate marking and lighting.

d. Experience has shown that low intensity lighting is of little use in daylight. Centerline lighting with an intensity of 80 candelas have been found to be effective at night with RVR down to 350 m, but higher intensity lights are recommended by day in visibility of this order on complicated taxi routes.

e. The location and spacing of taxiway lighting requires particular attention and closer spacing should be provided for operations in lower RVR conditions and on tighter radius turns.

f. Taxiway edge lights combined with taxiway centerline marking are adequate for operations in visibility conditions corresponding to RVR down to 350 m. (Refer Annex 14, Vol. I, 5.2.8).

g. For operations with RVR less than 350 m, centerline lighting is essential to provide continuous guidance between the runway centerline and aircraft stands, except where the traffic density is light and taxiway edge lights and centerline marking provide adequate guidance. (Refer Annex 14, Volume I, 5.3.16.1).

h. Where there may be a need to delineate the edges of a taxiway, e.g. on a rapid exit taxiway, narrow taxiway or in snow conditions, this may be done with taxiway edge lights or markers.

i. Provide lighting for all intermediate holding positions on an aerodrome for which ground movements are intended to be conducted while RAVC exist.

j. Provide lighting for each road-holding position serving a runway that may be used while RAVC exist.

3.7.12 Lighting should be provided for each road-holding position serving a runway when it is intended that the runway will be used in runway visual range conditions of values between 350 m and 550 m. (Refer Annex 14, Volume I, 5.3.27.2).

Stop Bars

3.7.13 The primary safety function of stop bars is to assist in the prevention of inadvertent incursion of active runways and penetration of obstacle free zone (OFZ) by aircraft when visibility is reduced. A stop bar is switched on to indicate that traffic stop, and switched off to indicate that traffic may proceed. Unless contingency measures are in force, aircraft or vehicles must not be instructed to cross illuminated stop bars when entering or crossing a runway.

3.7.14 The key elements relating to the design and operation of Stop Bars are detailed in Annex 14, Volume I, 5.3.20.

3.7.15 Except as specified in 3.7.14, a stop bar must be provided at each runway-holding position when it is intended that the runway will be used when RVR < 550 m. (Refer Annex 14, Volume I, 5.3.19.1 and 5.3.19.2)

3.7.16 The following exceptions may apply:

- Where appropriate aids and operational procedures are available to assist in preventing inadvertent incursions of aircraft and vehicles onto the runway; or
- Where operational procedures exist to limit, in RVR conditions less than a value of 550 m, the number of: o aircraft on the maneuvering area to one at a time; and o vehicles on the maneuvering area to the essential minimum.

3.7.17 Design requirements relating to stop bar lighting circuits are contained in Annex 14, Volume I, 5.3.19.13. Further guidance is available in the Aerodrome Design Manual, Part 5.

3.7.18 Except where a stop bar has been installed, intermediate holding position lights must be provided at intermediate holding positions intended for use when RVR < 350 m. (Refer Annex 14, Volume I, 5.3.20.1)

3.7.19 Where the normal stop bar lights might be obscured (from pilots view), for example, by snow or rain, or where a pilot may be required to stop the aircraft in apposition so close to the lights that they are blocked from view by the structure of the aircraft, then a pair of elevated lights should be added to each end of the stop bar. (Refer Annex 14, Volume I, 5.3.19.4)

3.7.20 When it is desired to provide traffic control by visual means or to supplement markings, stop bars should be provided at intermediate holding positions. (Refer Annex 14, Volume I, 5.3.19.3)

3.7.21 Unless the aerodrome layout, traffic density and applied operational procedures enable protection by other means as determined by the responsible authority, stop bars should be provided at all taxiways giving access to runways that will be used by aircraft conducting take-off or landing operations which require LVP to be in force. (Refer ICAO Doc 9365, 5.2.10)

3.7.22 The following practices relating to stop bars are recommended:

- a. Where deemed necessary to assist in preventing inadvertent access of vehicles or aircraft to a taxiway, provide a stop bar as a no-entry bar across a taxiway which is intended to be used as an exit only taxiway. (Refer ICAO Doc 9476, 5.3.2)

- b. Consider the provision of stop bars at runway-holding positions for use at night and when RVR >550 m. (Refer Annex 14, Volume I, 5.3.19, Note 2)
- c. Use stop bars (where provided) at least when RVR < 400 m. (Refer ICAO Doc 9365, 5.2.10)
- d. Establish contingency measures to cover cases where the stop bars or controls are unserviceable. Publish such contingency measure in the AIP.
- e. Runway-holding position markings, signs and stop bars may not by themselves be adequate during conditions of reduced visibility and runway guard lights are recommended as reinforcement.
- f. Consider partially automating the operation of stop bars, reducing the need for operating personnel to manually intervene on each occasion; for example, a “limited visibility” setting on the control panel might automatically illuminate stop bars closing access to taxiways which are not to be used when visibility is reduced or, following a manual switch-off of a stop bar, the stop bar would automatically switch back on triggered by the crossing aircraft. (Refer ICAO Doc 9365, 5.2.10)

Runway guard lights

3.7.23 Runway-holding position markings, signs and stop bars may not by themselves be adequate during conditions of reduced visibility and runway guard lights are recommended as reinforcement.

3.7.24 Runway guard lights are provided to warn pilots, and drivers of vehicles, when they are operating on taxiways that they are about to enter an active runway. Material relating to runway guard lights is detailed in Annex 14, Volume I, 5.3.22.

3.7.25 Runway guard lights, Configuration A, must be provided at each taxiway/runway intersection associated with a runway intended for use: • where the traffic density is heavy, when RVR < 1,200 m; and • where a stop bar is not installed, whenever RVR < 550 m. (Refer Annex 14, Volume I, 5.3.22.1)

Note: details of the configurations of runway guard lights are available at Annex 14, Volume I, Figure 5-23. 3.7.26 Runway guard lights, Configuration A or Configuration B or both, should be provided at each taxiway/runway intersection where enhanced conspicuity of the taxiway/runway intersection is needed, such as on a wide-throat taxiway, except that Configuration B should not be collocated with a stop bar. (Refer Annex 14, Volume I, 5.3.22.3)

Road-holding position lights

3.7.27 Road-holding position lights must be provided at each road-holding position serving a runway when it is intended that the runway will be used when RVR < 350 m. (Refer Annex 14, Volume I, 5.3.27.1)

3.7.28 Road-holding position lights should be provided at each road-holding position serving a runway when it is intended that the runway will be used when RVR < 550 m. (Refer Annex 14, Volume I, 5.3.27.2)

Rapid exit taxiway indicator lights (RETILs)

3.7.29 RETILs should be provided on a runway intended for use in runway visual range conditions less than a value of 350 m and/or where traffic is heavy. (Refer Annex 14, Volume I, 5.3.14.1)

3.7.30 RETILs should be provided in RAVC to provide the pilot with useful situational awareness cues regarding the runway centerline. (Refer Annex 14, Volume I, Attachment A, 14.2)

Precision Approach Lighting

3.7.31 Appropriate precision approach lighting systems must be provided in accordance with the provisions of Annex 14, Volume 1, para 5.3.4.22 to 5.3.4.39.

3.8 Signs.

3.8.1 Key elements relating to the location and characteristics of signs are specified in Annex 14, Volume I, Section 5.4 and Appendix 4.

3.8.2 Mandatory instructions signs, information signs and location signs must be provided for the use of pilots and vehicle drivers to assist awareness of their position and of the direction to follow. (Refer Annex 14, Volume I, 5.4.2)

3.8.3 Runway exit signs must be provided where there is an operational need to identify a runway exit. (Refer Annex 14, Volume I, 5.4.3.3)

3.8.4 Runway vacated signs must be provided where the exit taxiway is not provided with taxiway centerline lights and there is a need to indicate to a pilot leaving a runway the perimeter of the ILS critical/sensitive area or the lower edge of the inner transitional surface, whichever is farther from the runway centerline. (Refer Annex 14, Volume 1, 5.4.3.4)

3.8.5 Signs must be illuminated in accordance with the provisions of Appendix 4 of Annex 14 when intended for use:

- a. In runway visual range conditions less than a value of 800 m; or
- b. At night in association with instrument runways; or
- c. At night in association with non-instrument runways where the code number is 3 or 4.
(Refer Annex 14, Volume 1, 5.4.1.7)

3.8.6 The following practices relating to signs are recommended:

- a. Consider the need to provide visual clues to pilots under very low visibility. Designate taxiways, exits and entries in a manner which simplifies orientation on the aerodrome. (Refer Annex 14, Volume I, 5.4)
- b. Provide service roads and emergency access roads with adequate signs to enable drivers of emergency response vehicles to establish their position and route in the lowest visibility conditions in which the aerodrome maintains operations.
- c. Determine the location of signs laterally from the taxiway pavement edge, and the dimensions of the signs, considering the minimum visibility during which the aerodrome is used and the most restrictive aircraft type expected to operate at the aerodrome.

Low visibility departure operations

3.8.7 During low visibility departure operations, runway exit signs must be provided where there is an operational need to identify a runway exit. (Refer Annex 14, Volume I, 5.4.3.3)

3.8.8 During low visibility departure operations, runway vacated signs must be provided where the exit taxiway is not provided with taxiway centerline lights and there is a need to indicate to a pilot leaving a runway the perimeter of the ILS critical/sensitive area or the lower edge of the inner transitional surface (whichever is farther from the runway centerline). (Refer Annex 14, Volume I, 5.4.3.4)

3.8.9 During low visibility departure operations, signs must be illuminated in accordance with the provisions of Appendix 4 of Annex 14 when intended for use:

- a. In runway visual range conditions less than a value of 800 m;
- b. At night in association with instrument runways; or
- c. At night in association with non-instrument runways where the code number is 3 or 4.

(Refer Annex 14, Volume 1, 5.4.1.77)

3.8.10 During low visibility departure operations, aerodrome operators should consider limiting the number of runway exits, taking into account the traffic density and the availability of adequate means to control ground operations.

Approach and landing operations

3.8.11 During ILS Cat II approach and landing operations, runway exit signs must be provided where there is an operational need to identify a runway exit. (Refer Annex 14, Volume I, 5.4.3.3)

3.8.12 During ILS Cat II approach and landing operations, runway vacated signs must be provided where the exit taxiway is not provided with taxiway centerline lights and there is a need to indicate to a pilot leaving a runway the perimeter of the ILS critical/sensitive area or the lower edge of the inner transitional surface (whichever is farther from the runway centerline). (Refer Annex 14, Volume I, 5.4.3.4)

3.8.13 During ILS CAT II approach and landing operations, aerodrome operators should consider limiting the number of runway exits, taking into account the traffic density and the availability of adequate means to control ground operations.

3.8.14 During ILS CAT II approach and landing operations, aerodrome operators should consider providing runway vacated signs in all cases.

3.9 Aerodrome ground operations.

Unserviceable areas

3.9.1 Provisions relating to management of unserviceable areas during All Weather Operations are detailed at Annex 14, Volume I, 7.4.

3.9.2 The following practices relating to management of unserviceable areas during low visibility operations are recommended:

- a. Display movement area unserviceability lights on any areas used by aircraft while low visibility procedures are in force.
- b. Do not operate lighting on a closed runway or a closed or unauthorized taxiway or portion thereof while low visibility procedures are in force.
- c. Use mobile closure devices, positioned in such a way as to meet the appropriate

obstacle/obstruction clearance, frangibility and ILS localizer sensitive area clearance requirements.

Movement area

3.9.3 The following practices relating to management of movement areas during low visibility operations are recommended:

- a. Establish LVPs to ensure that, in good time prior to the bringing low visibility procedures into operation, all airlines and other organizations with access to movement areas are notified; and
- b. Establish LVPs to prevent unauthorized vehicular traffic from entering the movement area when low visibility operations are planned or are in force.

Aircraft ground operations

3.9.4 The following practices relating to management of aircraft ground operations during low visibility operations are recommended:

a. In determining restrictions to apply when low visibility operations are planned or in force, consider the pilot's ability to taxi, taking into account:

- taxiway lighting and markings;
- the availability, location and characteristics of position and information signs.

b. Consider the need to limit aerodrome declared capacity and movement rates taking into account items such as the effects of reducing visibility, the physical layout of the aerodrome, supporting/enabling facilities such as signs and lighting, the availability of ground surveillance systems.

c. Establish defensive measures against runway incursions, such as limiting the choice of taxi-routing, additional operational procedures and/or radar monitoring, stop bars at runway access/holding points, or other technical means.

3.9.5 Additional information is available in ICAO Doc 9476 - Manual of SMGCS, and ICAO Doc 9830 - Manual on A-SMGCS.

Vehicles and pedestrians

3.9.6 The general provisions relating to the on-aerodrome operation of vehicles are detailed in

GACAR §§ 139.59 and 139.60 and ICAO Annex 14, Volume I, Section 9.7 (Aerodrome Vehicle Operations).

3.9.7 Further guidance on aerodrome vehicle operations is contained in Annex 14, Volume 1, Attachment A, Section 18, and on traffic rules and regulations for vehicles in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).

3.9.8 The general provisions relating to the knowledge and qualification requirements for operators of vehicles are detailed at Annex 14, Volume I, Attachment A, Section 18.

3.9.9 The general provisions relating to the control of vehicles and pedestrians on the maneuvering area are detailed GACAR Part 139.

3.9.10 The driver of a radio-equipped vehicle must establish satisfactory two-way radio communication with the aerodrome control tower before entering the maneuvering area and with the appropriate designated authority before entering the apron. The driver shall maintain a continuous listening watch on the assigned frequency when on the movement area. (Refer GACAR § 139.60)

3.9.11 All vehicles employed on the maneuvering area must be capable of maintaining two-way radio communication with the aerodrome control tower, except when the vehicle is only occasionally used on the maneuvering area and is either accompanied by a vehicle with the required communications capability, or employed in accordance with a pre-arranged plan established with the aerodrome control tower. (Refer GACAR § 139.60)

3.9.12 Aerodrome operators should refer to the EAPPRI (European Action Plan for the Prevention of Runway Incursions) - Edition 2 - for consideration of those provisions to apply during conditions of reduced aerodrome visibility.

Operators of vehicles

3.9.13 If special operational procedures apply for operations in RAVC, an operator's knowledge of the operational procedures should be verified through periodic checks. (Refer Annex 14, Volume I, Attachment A, 18.4)

Vehicles and other mobile objects

3.9.14 Vehicles (excluding aircraft) operating on the maneuvering area during RAVC must be lighted. (Refer GACAR Part 139 and Annex 14, Volume I, 6.1.6)

Rescue and fire-fighting services

3.9.15 At locations where it is planned that taxi, take-off or landing operations will be permitted

in conditions where visual reference is limited by weather conditions, aerodrome operators must establish and/or provide suitable guidance, equipment and/or operational procedures to enable and support the provision of rescue and fire-fighting services in less than optimum conditions of visibility. (Refer Annex 14, Volume I, 9.2.26)

Vehicle documentation

3.9.16 All vehicles allowed onto the maneuvering areas while RAVC exist must be equipped with an airfield chart permanently displayed in the drivers cab clearly showing all taxiways, runways, holding points and vehicle routes marked with their appropriate designation.

3.9.17 Written instructions should be provided for vehicle drivers, clearly detailing the actions to be taken in the event that the vehicle should break down or that the driver should become unsure of his position on the airfield when RAVC exist.

Other requirements

3.9.18 The following practices relating to the operation of vehicles in low visibility operations are recommended:

a. Establish a driver education and training program covering:

- The aerodrome layout, the impacts of reduced visibility (orientation on the aerodrome);
- Special rules or operational procedures that will apply when reduced visibility occurs;
- The operation of low visibility procedures;
- The meaning of all markings, signs and aerodrome lighting; and
- Where appropriate, standard radio-telephony phraseology.

b. Ensure drivers are aware of defined boundaries of their approved area(s) of operations under various conditions.

c. Provide practical training to facilitate visual familiarization of airside service roads, taxiway crossings and any restrictions during RAVC. (Refer ICAO Doc 9870, Appendix D, 2.1)

d. Conduct training of those personnel who are intended to operate on the maneuvering area during conditions of reduced visibility:

- This training may include actual or simulated exercises;
- Conduct this training in close co-ordination with ATC, in order that such personnel may become familiar with the level of assistance which can be provided by ATC.

e. Periodically verify vehicle operators' knowledge of any special operational procedures to be applied in RAVC. (Refer Annex 14, Volume I, Attachment A, 18.4)

f. Conduct training of personnel operating on the maneuvering area during conditions of reduced visibility in close co-ordination with ATC, so that such personnel may become familiar with the level of assistance which can be given by ATC, and other special characteristics of LVP.

3.9.19 During low visibility operations:

a. Persons and vehicles must be restricted to the essential minimum. (Refer Annex 14, Volume I, 9.5.4, Doc 9476, 3.2.16)

b. Prior to bringing low visibility operations into force, the aerodrome control tower must maintain a record of vehicle and persons operating on the maneuvering area. (Refer PANS-ATM, 7.12.6)

Aerodrome emergency response

3.9.20 When low visibility operations are planned or are in force, establishing and reporting the accurate location of aircraft for the benefit of emergency response agencies takes on increased importance. As a matter of routine, aerodrome operators should:

a. Provide guidance for emergency vehicles responding during periods of RAVC. (Refer Annex 14, Volume I, Attachment A, 17.4.4).

b. Establish strategically located fire stations and/or stand-by positions on the movement area, locations determined to assist preserving emergency response times under various visibility conditions.

c. Consider the desirability at very large or complicated aerodromes of temporarily relocating RFFS vehicles to strategic points while RAVC exist.

d. Establish facilities and operational procedures enabling continuous communication between ATC and leading response agencies (such as Rescue and Fire Fighting vehicles).

e. Provide service roads and emergency access roads with adequate signs and markings which enable drivers to establish their position and route in the lowest visibility conditions in which the aerodrome maintains operations.

3.9.21 Aerodrome control agencies should use all available aids, including ground surveillance aids (such as Surface Movement Radar and A-SMGCS where available), to assist emergency response agencies proceed quickly to an emergency site.

Apron management service

3.9.22 At some aerodromes an Apron Management Service may be established to manage the movement of aircraft, vehicles and persons over the apron areas. The safe and effective movement of aircraft and vehicles requires both management and traffic regulation. The demand for traffic regulation will considerably increase in very low visibility where pilots and drivers of vehicles are hampered in identifying position and routing and in their ability to avoid other traffic. Therefore, special operational procedures should be developed by the unit operating the Apron Management Service to manage the movement of aircraft and vehicles on the apron for the lowest visibility conditions under which the aerodrome will maintain operations.

3.9.23 The interface between the Apron Management Service and ATC is particularly important during low visibility operations. A formal Service Letter Agreement (SLA) between ATC and the Apron Management Service should define the operational procedures to be used and clearly state the tasks and responsibilities of each party in low visibility operations, in particular including provisions for the movement of vehicles on the apron.

3.9.24 Provisions relating to the establishment and provision of Apron Management Services (AMS) are detailed at Annex 14, Volume I, 9.5.

3.9.25 Further guidance on an apron management service is given in the Airport Services Manual (Doc 9137), Part 8, and in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).

3.9.26 Where low visibility procedures are in force, persons and vehicles operating on an apron must be restricted to the essential minimum. (Refer Annex 14, Volume I, 9.5.4)

3.9.27 When warranted by the volume of traffic and operating conditions, it is recommended that an appropriate apron management service be provided. (Refer Annex 14, Volume I, 9.5.1)

3.9.28 The following practices relating to apron management services in low visibility operations are recommended:

- a. When meteorological conditions limit visual reference, restrict persons and vehicles operating on an apron to the essential minimum.
- b. The unit operating the Apron Management Service should develop special operational procedures to manage the movement of aircraft and vehicles on the apron for the lowest visibility conditions under which the aerodrome will maintain operations.
- c. A Service Level Agreements (SLA) should be established between ATC and the Apron Management Service defining the procedures to be used, and clearly stating the tasks and responsibilities of each party when RAVC exist, and/or while low visibility procedures are in force, in particular including provisions for the movement of vehicles on the apron.

3.10 Low Visibility Procedures

3.10.1 Aerodrome Operators must develop and provide for approval a set of Low Visibility Procedures (LVP) that meet the following objectives:

- a. Protect active runways against incursions by aircraft, vehicular and pedestrian traffic;
 - b. Facilitate the availability of various support equipment and facilities (including for example, RVR equipment and aerodrome lighting) to prescribed levels of availability and redundancy, to support those flight operations which require LVP to be in force;
 - c. Preserve the accuracy of radio navigation aids, for example via protection of ILS Critical and Sensitive Areas;
 - d. Support the efficient flow of aircraft, mainly between terminal buildings and runways, but also between other areas, such as aprons and maintenance facilities;
 - e. Reduce the possibility of conflicts between the aircraft, vehicular and pedestrian traffic;
 - f. Assist ATC and/or Apron Management staff to maintain situational awareness of the positions of traffic on the maneuvering area and aprons;
 - g. Facilitate coordinated action by various agencies, including the aerodrome and aircraft operators, rescue and fire fighting services, vehicle operators and drivers, MET and AIS providers, and ATS; and
 - h. Ensure that accurate and timely information is available to pilots regarding the status of relevant supporting systems, including equipment, facilities, meteorological conditions and the LVP themselves.
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3.10.2 Development and establishment of the provisions necessary to achieve these objectives will require the cooperative efforts of many aerodrome stakeholders, including but not be limited to, the aerodrome operator, airport safety and security agencies, ground support providers and major operators, technical and engineering section(s) responsible for establishment and/or maintenance of visual and non-visual aids and power supplies, meteorological services, air traffic services, and the rescue and fire-fighting services.

3.10.3 Before starting to develop the facilities, equipment and operational procedures necessary to support aerodrome operations that require LVP to be in force, the aerodrome operator will need to coordinate with aerodrome stakeholders to ascertain the:

- a. Incidence of RAVC;
- b. Volume of traffic expected to operate in such conditions;
- c. Assessment of current needs and equipment; and
- d. Justification for such operations.

3.10.4 In developing the LVP the aerodrome operator must:

- a. Establish the worst conditions (lowest visibility/RVR &/or height of cloud base at which the aerodrome intends to operate;
- b. Complete a comprehensive safety and security assessment of the total aerodrome movement area and its operations;
- c. Provide any additional and/or more reliable ground aids and equipment;
- d. Provide for more comprehensive control of ground traffic;
- e. Provide specific Low Visibility Procedures and regulations for implementation by the relevant affected agencies;
- f. Assess the RFF deployment and response time; and
- g. Provide appropriate training and qualification of relevant personnel.

3.10.5 In developing LVP the aerodrome operator must also consider various factors including, but not limited to:

- a. Determination of the aircraft flight operations to be supported by LVP;
- b. Determination of desired movement rates, and evaluation of impacts on airport capacity while LVP are in force;
- c. Evaluation of aerodrome visual aids, existing and as required to support operations that require LVP, including assessment of aerodrome markings, lighting systems and signs for suitability; and
- d. Evaluation and establishment of meteorological elements existing and as required to support operations that require LVP:
 - Determination of the limits for initiating and terminating LVPs;
 - Examination of available meteorological equipment used by meteorological services; and
 - Evaluate the need to establish the additional meteorological facilities and services for the desired flight operations.
- e. Evaluation of AIS and FIS requirements, such as requirements for change to the AIP, such as aeronautical charts and AIP entries required to support LVP, and the need for ATIS facilities;
- f. Evaluation of requirements for communications between ATC and aircraft, vehicles, rescue and fire- fighting services, meteorological services, engineering support, security, apron control, other ATC units, air traffic flow management and other units/authorities/services affected by LVP;
- g. Determination of the non-visual aids to navigation needed to support operations that require LVP, particularly all components of ILS and associated monitoring systems;
- h. Determination of critical and sensitive areas for ILS glidepath and localizers;
- i. Evaluation of existing operational procedures and requirements for visual and non-visual aids, meteorological instrumentation and power supplies;
- j. Evaluation of the suitability of existing, or need for new surveillance systems for ground movements;

- k. Evaluation of existing airport access control measures;
- l. Evaluation of ground and access restrictions that would be necessary to preserve the safety of aircraft operations while LVP are in force, considering ground support services, such as re-fuelling, cleaning, maintenance, cargo and baggage handling and catering services;
- m. Evaluation of the risk of runway incursions, including a review of the history of runway incursions and taxiway conflict incidents (runway hotspots, runway safety team);
- n. Evaluation of airport layout with particular attention to taxi routes between aprons and runways, ground traffic routes, service roads, access control points, access point to the movement area, and existing control mechanisms;
- o. Evaluation of existing ATC and AMS rules and operational procedures for compatibility with LVP;
- p. Evaluation of the suitability of inter-unit Letters of Agreement for supporting LVP;
- q. Evaluation of training and competence requirements for operational staff (for example, safety officers, airside drivers, RFFS, maintenance crews, technicians, AMS & ATC); and
- r. Evaluation of impact of LVP on rescue and fire-fighting services on emergency response times.

3.10.6 Once Low Visibility Procedures have been approved by the President, they must be published in the appropriate local aerodrome instructions and also in the AIP in the AD section (Refer Annex 15, Appendix 1, Part III). At this point the LVP have been established. The LVP must then activated and brought into in force and applied whenever the following types of operations (as appropriate or approved) are in progress:

- a. Departure operations in RVR conditions less than a value of 550 m;
- b. CAT II approach and landing operations;
- c. Other Than Standard CAT II approach and landing operations;
- d. Lower Than Standard CAT I approach and landing operations.

3.11 Aerodrome Survey Requirements and Obstacle Limitation Criteria

3.11.1 Aerodrome operators must ensure that the all relevant aerodrome survey requirements are

met as part of the approval process for low visibility procedures. Survey requirements are detailed in GACA Document SER/ASSD/Survey-01 – Aerodrome Survey Requirements – Standards, Guidance and Information for Aerodrome Operators and Surveyors. This document is available from the GACA.

3.11.2 Criteria for obstacle limitation surfaces are specified in Annex 14, Volume I. Guidance on obstacle limitation surfaces for runways using ILS is given in ICAO Doc 9137, Part 6. The limitation of obstacles in, and the dimensions of, an obstacle-free zone are prescribed in Annex 14, Volume I. For Category II and III operations, the obstacle-free zone, extended to the appropriate Category II obstacle clearance height, should not be penetrated by any obstacle except those specifically permitted in Annex 14, Volume I.

Pre-threshold terrain

3.11.3 Annex 4 requires that a precision approach terrain chart be published by States providing facilities for Category II operations, and ICAO Doc 8697 provides guidance on the production of suitable charts. The operation of some automatic landing systems is dependent on the radio altimeters. The flare profile, rate of descent at touchdown, and the distance of the touchdown point from the runway threshold can be affected by the profile of the terrain immediately prior to the threshold.

3.11.4 The terrain which is most critical lies in an area 60 m either side of the runway centerline extending into the approach area to a distance of at least 300 m before the threshold. The guidance material in Annex 14, Volume I, makes reference to the maximum slopes of pre-threshold terrain which are normally acceptable when planning a new runway on which operations are to include coupled approaches and automatic landing. However, radio altimeter inputs may also be required when the aircraft is on final approach as much as 8 km (5 NM) from touchdown.

3.11.5 At aerodromes where the terrain beneath the approach flight path is not level, abnormal autopilot behavior may result as follows:

- a. Where the terrain under the approach is markedly lower than the threshold, the radio altimeter input for a particular stage of the approach may be signaled later than required;
- b. Where the terrain under the approach is markedly higher than the threshold, the radio altimeter input for a particular stage of the approach may be signaled sooner than required; and
- c. Where the terrain consists of a series of ridges and valleys, an input of incorrect altitude information to the automatic flight control systems may take place. This may result in

unacceptable autopilot and flight-path behavior.

3.11.6 Where the characteristics of the terrain are considered marginal for a particular aircraft type, a demonstration should be made to determine that the performance or function of the automatic flight control system is not adversely affected. The demonstration may take the form of flight trials or a suitable analysis. Any additions or alterations to existing structures or terrain in the pre-threshold area should be considered for their effect on published information. In the event that an alteration has a significant effect on radio altimeters, the amended data relating to the terrain profile should be rapidly disseminated.

3.11.7 In accordance with Annex 4, Chapter 6, the precision approach terrain chart depicts a profile of the terrain to a distance of 900 m (3 000 ft) from the threshold along the extended centerline of the runway. Therefore determination of DA/H by means of the radio altimeter should consider the approach terrain out to 900 m from the threshold.

3.12 Letters of Agreement

3.12.1 Aerodrome operators must establish appropriate letters of agreement relating to low visibility procedures. This specifically includes a letter of agreement with the following organisations:

- The air traffic services (ATS) provider at the aerodrome;
- The aeronautical telecommunications provider responsible for the CNS infrastructure at the aerodrome;
- The meteorological service provider for the aerodrome.

3.13 Aerodrome Safety Assessment

3.13.1 In conditions of limited visibility, air traffic controllers may no longer be able to see the entire movement area of the aerodrome, but flight crews will still have the capability to see and avoid other traffic in their vicinity. In worse conditions, neither the controller nor the flight crews may be able to see other proximate traffic, and it may then become essential to have a system which effectively ensures the separation of aircraft from aircraft or from vehicles. Guidance on such systems is given in ICAO Doc 9476 and ICAO Doc 9830.

3.13.2 In creating operational procedures for surface movements in limited visibility, a comprehensive safety assessment of the aerodrome should be undertaken. Such an assessment requires examination of all the relevant factors such as layout of the movement area and aircraft and vehicle routings, relevant existing instructions and rules, meteorological records, movement

statistics, records of runway intrusions, and existing security procedures. The required actions identified by an assessment will be influenced by the characteristics of the movement area and the type(s) of operation and should include the following:

- a. Training of ground personnel;
- b. ATS tracking, control, and communication of the movement of persons and vehicles on the maneuvering area;
- c. Withdrawing non-essential personnel and vehicles from movement areas when limited visibility weather conditions prevail or are impending;
- d. Permitting essential vehicles with radiotelephony communication with ATS to enter the movement area in limited visibility conditions;
- e. Patrolling in areas of intensive vehicle movement where there is no traffic control point between those areas and the runway;
- f. Locking and inspecting unguarded aerodrome entrances at frequent intervals;
- g. Having operational procedures to warn airlines and other organizations with movement-area access of the commencement of the more restrictive measures; and
- h. Developing appropriate emergency procedures.

3.13.3 Guidance on low visibility operations and examples of low visibility procedures are given in ICAO Doc 9476.