International Civil Aviation Organization

The Seventh Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/7)

(Bangkok, Thailand, 17 to 20 February 2026)

Agenda Item 5: Asia and Pacific Regional Guidance

DEVELOPMENT OF GUIDANCE MATERIAL ON THE USE OF "AS FAR AS PRACTICABLE" (AFAP) AND RELATED PHRASES IN ICAO ANNEX 14, VOLUME I

(Presented by AUSTRALIA, MALAYSIA, NEPAL (LEAD), NEW ZEALAND, PAKISTAN)

SUMMARY

This paper presents proposal on the development of ICAO regional guidance material to clarify the interpretation and application of the phrase "As Far As Practicable"/ "Wherever practicable" and similar conditional expressions used in ICAO Annex 14, Volume I, to promote consistent implementation, oversight, and auditing by States.

1. INTRODUCTION

1.1 In the Sixth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/6), held in Langkawi, Malaysia from 18 – 21 February 2025, Malaysia presented the WP/15 which highlighted the challenges and risks posed by the phrase "as far as practicable" in ICAO Annex 14, Volume I. While intending to offer flexibility in implementing SARPs, the texts "as far as practicable" could create confusion that could result in inconsistent application and compliance. Consequently, such discrepancies might lead to differing interpretations among different parties.

1.2 Malaysia proposed a need for clearer guidelines alongside a standardized interpretation framework to ensure regulatory consistency and effective decision-making. Additionally, establishing minimum safety thresholds could enhance aviation safety and promote harmonization across States practices.

1.3 AP-ADO/TF/6 agreed to form a SWG consisting of SMEs from Nepal (Lead) supported by Australia, Malaysia, Welington International Airport (New Zealand) and Pakistan to develop a generic guidance for circumstances/situations where the phrase "as far as practicable and/or wherever practicable" would be needed for flexibility of the implementation of SARPs based on experiences and best practices of APAC States from different geographical regions and decided to add into the AP-ADO/TF Task List as Task 6/3.

1.4 The SWG held couple of virtual meetings in January 2026 in coordination of APAC Secretariate to brainstorm and gather information on the practices by States in APAC Region. Australia shared a document named "INTERPRETIVE GUIDELINE – MODEL WORK HEALTH AND SAFETY ACT: THE MEANING OF REASONABLY PRACTICABLE" which is attached in **Attachment A**, New Zealand shared some of their practices in relation to Task 6/3 which is attached in **Attachment B** and Pakistan shared A CASE STUDY OF CERTIFICATION OF RWY 14R-32L FOR CODE 3C/4C AIRCRAFT OPERATIONS (A320/B737) AT SKARDU INTERNATIONAL AIRPORT (OPSD), PAKISTAN) which is attached in **Attachment C** to this WP.

2. DISCUSSION

2.1 There are approximately 70 numbers of As Far As Practicable/Wherever Practicable (AFAP)[1], and approximately 45 numbers of As Low As POSSIBLE (ALAP)[2] type of conditional expressions appeared in the in ICAO Annex 14, Volume I. The Chapter wise distribution of these phrases appeared in the Standards, Recommended Practices, and Attachment A to Annex 14, Volume I are summarized in the Table below:

Table: AFAP and ALAP Phrases

Ch.	AFAPs in STD	ALAPs in STD	AFAPs in RP	ALAPs in RP	Total Numbers
3	1	-	14	4	**15** AFAPs **4** ALAPs
4	-	2	7	-	**7** AFAPs **2** ALAPs
5	13	12	15	2	**28** AFAPs **14** ALAPs
6	9	-	2	-	**11** AFAPs **0** ALAPs
7	1	2	-	-	**1** AFAPs **2** ALAPs
8	-	-	1	-	**1** AFAPs **0** ALAPs
9	1	4	-	3	**1** AFAPs **7** ALAPs
10	-	1	1	-	**1** AFAPs **1** ALAPs
	25	**21**	**40**	**9**	**65** AFAPs **30** ALAPs

Ch.	AFAPs	ALAPs	
ATT A	Total 6 nos.	Total 16 nos.	**6** AFAPs **16** ALAPs
Tables	Table 5-2. b	Figure 5-19. e	

2.2 The full details of these phrases are attached in **Attachment D** to this WP.

2.3 Annex 14, Volume I does not define – What constitutes "practicable"; How constraints should be identified, assessed, or documented; What level of mitigation is expected when full compliance is not practicable. In the absence of guidance, States apply differing thresholds for – Technical feasibility; Economic reasonableness; Operational impact; Safety equivalence. This situation undermines – Uniform application of SARPs; Transparency of compliance decisions; Predictability of USOAP audit outcomes.

2.4 "As far as practicable/Wherever Practicable" and "As Low As Possible" should not be interpreted as discretionary or optional compliance, but as – (i) a requirement to achieve the highest level of compliance reasonably achievable under demonstrated constraints; and (ii) an obligation to implement an equivalent level of safety is achieved through alternative means where full compliance is not feasible. Without a formal ICAO guidance, States develop ad hoc national interpretations, reducing

[1] AFAP – This abbreviation is used to capture all SARPs where As Far As Practicable / Wherever Practicable, etc. phraseology has been used in Annex 14, Volume I.
[2] ALAP – This abbreviation is used to capture all SARPs where As Low As Possible / As Far As Possible / Wherever Possible, etc. phraseology has been used in Annex 14, Volume I.

global harmonization.

2.5 The guidance material should include, at a minimum:

- A standardized definition of "practicable" in the Annex 14, Volume I context;
- Criteria for determining impracticability (technical, operational, environmental, economic, safety-related);
- Required documentation and justification by aerodrome operators;
- Expectations for approval by the appropriate authority;
- Examples of acceptable alternative means of compliance and safety equivalence; and
- Guidance for CAA Inspectors/Aerodrome Operators on assessment methodology.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) share relevant best practices related to Paragraph 2.5 by States/Administrations in APAC Region; and

c) discuss any relevant matters as appropriate.

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safe work australia

INTERPRETIVE GUIDELINE—MODEL WORK HEALTH AND SAFETY ACT
THE MEANING OF 'REASONABLY PRACTICABLE'

This document provides guidance on the interpretation and application of the term 'reasonably practicable' in considering the standard of health and safety that a person conducting a business or undertaking (the duty-holder) is expected to meet under the *Work Health and Safety* (WHS) Act and Regulations.

'Reasonably practicable' is used to qualify duties to ensure health and safety and certain other duties in the WHS Act and Regulation. This standard and what is required to meet it in relation to a health and safety duty are set out in section 18.

How is 'reasonably practicable' defined?

In this context, *reasonably practicable* means that which is, or was at a particular time, reasonably able to be done to ensure health and safety, taking into account and weighing up all relevant matters including:

(a) the likelihood of the hazard or the risk concerned occurring

(b) the degree of harm that might result from the hazard or the risk

(c) what the person concerned knows, or ought reasonably to know, about the hazard or risk, and ways of eliminating or minimising the risk

(d) the availability and suitability of ways to eliminate or minimise the risk, and

(e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

What is 'reasonably practicable' is an objective test

What is 'reasonably practicable' is determined objectively. This means that a duty-holder must meet the standard of behaviour expected of a reasonable person in the duty-holder's position and who is required to comply with the same duty.

There are two elements to what is 'reasonably practicable'. A duty-holder must first consider *what can be done* - that is, what is possible in the circumstances for ensuring health and safety. They must then consider whether it is *reasonable, in the circumstances* to do all that is possible.

This means that what can be done should be done unless it is reasonable in the circumstances for the duty-holder to do something less.

This approach is consistent with the objects of the WHS Act which include the aim of ensuring that workers and others are provided with the highest level of protection that is reasonably practicable.

How to determine what is reasonably practicable – the process

To identify what is or was reasonably practicable all of the relevant matters must be taken into account and weighed up and a balance achieved that will provide the highest level of protection that is both possible and reasonable in the circumstances. Some matters may be relevant to what *can* be done, while others may be relevant to what is *reasonable* to do.

No single matter determines what is (or was at a particular time) reasonably practicable to be done for ensuring health and safety.

What must be taken into account and weighed up

Although section 18 sets out specific considerations, they are not the only things that may be relevant and other things may also need to be considered.

For example:

- there may be other legislation that requires or prohibits certain activities and limits what a duty-holder can do and the duty-holder must do what they reasonably are able to while complying with that other legislation; and
- whether a duty-holder can control or influence a particular thing or the actions of another person, or any limits on their ability to control or influence, may be relevant to what the duty holder *can* do, or what they may *reasonably* be expected to do. The WHS Act makes it clear, however, that a duty-holder cannot avoid responsibility by a contract giving control to someone else and through that attempting to contract out of their obligations.

The duty-holder should consider all of the facts and identify and consider everything that may be relevant to the hazards, risks or means of eliminating or minimising the risks.

The matters that must always be taken into account and weighed up are the following:

(a) The likelihood of the hazard or the risk concerned occurring

The greater the likelihood of a risk eventuating, the greater the significance this will play when weighing up all matters and determining what is reasonably practicable. If harm is more likely to occur, then it may be reasonable to expect more to be done to eliminate or minimise the risk.

(b) Degree of harm that may result if the hazard or risk eventuated

The greater the degree of harm that could result from the hazard or risk, the more significant this factor will be when weighing up all matters to be taken into account and identifying what is reasonably required (what is reasonably practicable) in the circumstances. Clearly, more may reasonably be expected of a duty-holder to eliminate or minimise the risk of death or serious injury than a lesser harm.

(c) What the person concerned knows, or ought reasonably to know, about the hazard or risk and any ways of eliminating or minimising the risk

The knowledge about a hazard or risk, and any ways of eliminating or minimising the hazard or risk, will be what the duty-holder actually knows, and what a reasonable person in the duty-holder's position (e.g. a person in the same industry) would reasonably be expected to know. This is commonly referred to as the *state of knowledge*.

A duty-holder can gain this knowledge in various ways, for example by:

- consulting their workers and others in the industry
- undertaking risk assessments
- analysing previous incidents
- considering relevant Regulations and Codes of Practice and other sources of information such as:
  - the regulator and its inspectors
  - reputable technical standards, such as those published by Standards Australia
  - industry publications, and
  - published scientific and technical literature.

Knowledge about the hazard or risk

It is reasonably practicable for a duty-holder to:

- Proactively take steps to identify hazards within their business or undertaking before they cause an incident, injury or illness. This should be done before the activity is undertaken or the circumstances occur that result in the risk.
- Understand the nature and degree of any harm that an identified hazard may cause, how the harm could occur, and the likelihood of the harm occurring.

It is also reasonably practicable for a duty-holder to consider and understand, within the available state of knowledge, how the following may cause or increase hazards and risks:

- potential failure of plant, equipment, systems of work or safety measures
- human error or misuse, spontaneity, panic, fatigue or stress, and
- interaction between multiple hazards that may, together, cause different risks.

Knowledge about ways of eliminating or minimising the risk

Regulations and Codes of Practice made under the WHS Act and other relevant legislation may identify ways to eliminate risks to health and safety, so far as is reasonably practicable and if that is not reasonably practicable to minimise risks so far as is reasonably practicable (referred to as *control measures*). Control measures set out in the WHS Act and Regulations must be complied with.

While duty-holders are not obliged to comply with Codes of Practice, they are expected to identify and consider this information. A court may have regard to a Code of Practice approved under the WHS Act as evidence of what is known about a hazard or risk, risk assessment or risk control, and rely on the code in determining what is reasonably practicable in the circumstances to which the code relates.

There may be many different ways of eliminating or minimising risks. The duty-holder should identify as many of these as they reasonably can, to give them the greatest scope to choose and apply the most appropriate means to eliminate or minimise a risk in the particular circumstances.

The ways of eliminating or minimising risks are ranked from most effective and reliable to the least effective and reliable (known as the *hierarchy of risk controls*) and are described below.

(d) Availability and suitability of ways to eliminate or minimise risks

This part requires a consideration of not only what is available, but also what is suitable for the elimination or minimisation of risk. A risk control that may be effective in some circumstances or environments may not be effective or suitable in others, because of things such as the workplace layout, skills of relevant workers, or the particular way in which the work is done.

Equipment to eliminate or minimise a hazard or risk is regarded as being *available* if it is provided on the open market, or if it is possible to manufacture it.

A work process (or change to a work process) to eliminate or minimise a hazard or risk is regarded as being *available* if it is feasible to implement.

A way of eliminating or minimising a hazard or risk is regarded as *suitable* if it:

- is effective in eliminating or minimising the likelihood or degree of harm from a hazard or risk;
- does not introduce new and higher risks in the circumstances; and
- is practical to implement in the circumstances in which the hazard or risk exists.

The hierarchy of risk controls

The ways of controlling risks are ranked from the highest level of protection and reliability to the lowest. This ranking is known as the *hierarchy of risk control.* The WHS Regulations require duty-holders to work through this hierarchy to choose the control that most effectively eliminates or minimises the risk in the circumstances.

- A duty-holder must eliminate health and safety risks so far as is reasonably practicable. If there are no available or suitable ways to eliminate a hazard or risk, then a duty-holder must consider all available and suitable ways to minimise risks, so far as is reasonably practicable by: substituting a hazard with something, or a number of things, that gives rise to a lesser risk
- isolating the hazard from any person exposed to it
- implementing engineering controls

If there is a remaining risk, it must be minimised so far as is reasonably practicable by implementing administrative controls, and if a risk still remains, then suitable personal protective equipment must be provided and used.

How far a control may minimise risk, on its own or together with other controls, should be considered when weighing up what can reasonably be done. Some of the controls may lower the likelihood of harm, others may lower the degree of harm that may result, and some may lower both.

(e) Cost of eliminating or minimising the risk

Although the cost of eliminating or minimising risk is relevant in determining what is reasonably practicable, there is a clear presumption in favour of safety ahead of cost.

The cost of eliminating or minimising risk must only be taken into account **after** identifying the extent of the risk (the likelihood and degree of harm) and the available ways of eliminating or minimising the risk.

The costs of implementing a particular control may include costs of purchase, installation, maintenance and operation of the control measure and any impact on productivity as a result of the introduction of the control measure.

A calculation of the costs of implementing a control measure must take into account any savings from fewer incidents, injuries and illnesses, potentially improved productivity and reduced turnover of staff.

In identifying whether a particular expenditure is reasonable in the circumstances, the duty-holder must consider:

- the likelihood and degree of harm of the hazard or risk; and
- the reduction of the likelihood and/or degree of harm that will result if the control measure is adopted.

The more likely the hazard or risk is, or the greater the harm that may result from the hazard, the less weight should be given to the cost of eliminating the hazard or risk.

The cost of risk control options, individually and together, may be relevant when deciding which of the available options are reasonably practicable, in a number of ways.

If there are a number of options available for eliminating or minimising a risk that achieve the same level of reduction in likelihood or degree of harm, a duty-holder may choose to apply a number of the least costly options. Using more expensive risk control options may not be required to minimise a risk that is low in likelihood or severity of harm.

Cheaper, available and suitable options may be used instead of a costlier option that may further minimise the risk or severity of harm, where the cost of the costlier option is grossly disproportionate to the risk. This will only apply where the cost is high and the likelihood or degree of harm is low (e.g. a slight chance of minor cuts or strains and the cost of replacing plant would be very high).

Choosing a low-cost option that provides less protection simply because it is cheaper is unlikely to be considered a reasonably practicable means of eliminating or minimising risk.

If the degree of harm is significant (e.g. death or serious injury is at least moderately likely) then it is unlikely that the cost of implementing available and suitable safety measures to eliminate or minimise the risk would ever be so disproportionate to the risk to justify a decision not to do so.

It may be reasonable to expect (and require) a duty-holder to eliminate the risk by ceasing the relevant activity if, after all ‘affordable’ control measures have been considered, there remains a significant risk of serious injury or illness.

Where the cost of implementing risk controls is grossly disproportionate to the risk – e.g. the cost of engineering changes to plant will be high and there is only a slight risk of minor sprains - then this may mean the use of those controls is not reasonable and not required. This does not, however, mean that the duty-holder is excused from doing anything to minimise the risk so far as is reasonably practicable. It may simply mean that a less expensive way of minimising the likelihood or degree of harm may instead be used.

Capacity to pay is not relevant

The question of what is 'reasonably practicable' is to be determined objectively, and not by reference to the duty-holder's capacity to pay or other particular circumstances. A duty-holder cannot expose people to a lower level of protection simply because it is in a lesser financial position than another duty-holder.

If two duty-holders are faced with the same hazard or risk in similar situations, one duty-holder cannot expose people to a lower level of protection simply because it is in a lesser financial position than another duty-holder.

If there are options available for eliminating or minimising a risk that achieve the same level of reduction in likelihood or degree of harm, a duty-holder may choose the least costly option. However, choosing a low cost option that provides less protection simply because it is cheaper is unlikely to be considered a reasonably practicable means of eliminating or minimising risk.

The costs of implementing a particular control may include costs of purchase, installation, maintenance, operation of the control measure and any impact on productivity as a result of the introduction of the control measure.

If a particular duty holder cannot afford to implement a control that is not so disproportionate to the risk as to be clearly unreasonable, the duty holder should not engage in the activity that gives rise to that hazard or risk.

The operation of 'reasonably practicable' – an example

ABC Pty Ltd manufactures metal products used as components in industrial machinery. These are stamped on a press. Different dies are used for different items and the dies must be manually changed before each product run. The dies are heavy and are difficult to reach.

In this case, the company:

- Consults its workers to assist in identifying the hazards associated with the work, which are the cutting and crush hazards associated with the operation of the machine and the hazardous manual task associated with the changing of the die.
- Identifies the potential harm to the operators, which are crush amputation injuries and musculoskeletal injuries. These are assessed as having at least a moderately high likelihood of occurring if risk controls are not implemented and maintained.
- Determines the requirements for plant under the WHS Regulations and obtains information from relevant codes of practice and machinery suppliers about the various mechanical and other ways of minimising the likelihood or degree of harm. The option of replacing the machine with another that does not have the risks, or has in place means for minimising the risks to the lowest level is considered. Another option includes retrofitting guards to prevent the crush injuries and to use mechanical aids for the extraction, lifting and movement of the dies. These various measures will need to be supported by appropriate systems of work, training and supervision.
- Identifies which of the options are available and suitable for use in the circumstances and the degree to which they will individually or together eliminate or if that is not possible minimise the risks so far as is reasonably practicable. Considers whether particular risk controls may introduce other hazards or increase other risks.

Stopping the activity would eliminate the risk of amputation, crush injury and musculoskeletal injury, however, this option is not a realistic alternative as the stamping operation is an integral and necessary step in the manufacture of the dies.

Having identified what can reasonably be done, weighed up the degree and likelihood of harm and how far a control may minimise risk, ABC decides to purchase a new computerised machine which has come onto the market that does not require manually changing the dies. This option

eliminates the hazardous manual task. The machine also includes a cut-off to stop the operation so that workers do not come into contact with moving parts during routine maintenance on the machine. It also produces less noise, which will minimise the risk of hearing loss.

Although the new machine is more expensive than retrofitting the existing machine with guarding, it provides significant health and safety benefits and also increases efficiency. Given the severity of harm and likelihood of it occurring, the costs are considered unlikely to be grossly disproportionate to the risk. If a new machine with improved design controls was not suitable or available, ABC could opt to retro-fit guards and sound minimising devices to the existing machines. This would also minimise the identified risks so far as is reasonably practicable.

ABC installs the new machine according to the manufacturer's instructions and provides its workers with relevant training on the safe operation and maintenance. The effectiveness of the risk controls are reviewed after one month in consultation with workers.

Note: this document is a general guideline only and is not a substitute for professional legal advice. The contents of this document are correct at the time of writing. However, there may be subsequent decisions of courts or tribunals on the matter covered by this guide which mean that the contents are no longer accurate.

Dimensions of runway end safety areas

3.5.4 ***Recommendation.****— A runway end safety area should, as far as practicable, extend from the end of a runway*

— 240 m where the code number is 3 or 4; or a reduced length when an arresting system is installed;

There have been two examples in New Zealand of where Engineered Material Arresting Systems have been accepted as an acceptable alternative means of compliance providing the equivalent of 240m of RESA for design aircraft types, *aircraft providing or proposed to provide scheduled services at the airport*, where the available land area and typography preclude this.
The installation of EMAS has been completed at one airport during 2025 WNQN (ZQN), whereas the installation of EMAS at NZWN (WLG) will be completed in April 2026. Picture of EMAS installation at NZQN attached.

5.3.4 Approach lighting systems
Application

5.3.4.1 Application

A.— Non-instrument runway

Recommendation.— *Where physically practicable, a simple approach lighting system as specified in 5.3.4.2 to 5.3.4.9 should be provided to serve a non-instrument runway where the code number is 3 or 4 and intended for use at night, except when the runway is used only in conditions of good visibility and sufficient guidance is provided by other visual aids.*

Note.— A simple approach lighting system can also provide visual guidance by day.

B.— Non-precision approach runway

Where physically practicable, a simple approach lighting system as specified in 5.3.4.2 to 5.3.4.9 shall be provided to serve a non-precision approach runway, except when the runway is used only in conditions of good visibility or sufficient guidance is provided by other visual aids.

Note.— It is advisable to give consideration to the installation of a precision approach category I lighting system or to the addition of a runway lead-in lighting system.

C.— Precision approach runway category I

Where physically practicable, a precision approach category I lighting system as specified in 5.3.4.10 to 5.3.4.21 shall be provided to serve a precision approach runway category I.

Context:

At NZWN, the runway is geographically constrained by sea at either end of the runway. At the southern extremity of the airport, the runway has been extended into the open sea which frequently experiences swell conditions in excess of 8m. This combined with a water depth of greater than 20m makes it difficult to install or safely maintain an approach lighting system at that end of the runway. At the northern end of the runway, situated 12m above sea level, the runway is bounded by an operational harbour environment with marine vessels operating. The inclusion of approach lighting, in an environment which is not controlled by the aerodrome operator, would significantly impede the operation of the harbour. It is also worth noting that the bulk supply of jet fuel for the airport is transported by ship and delivered to a wharf site near the northern end of the runway.

Following an aeronautical study, the airport operator has been granted an exemption from the installation of an approach lighting system for each runway on the basis that it is not physically practicable to do so based upon the elements described. The aeronautical study also highlighted as mitigation:

- An Instrument landing system is provided for each runway direction.
- The Minimum Descent Altitude for these runways has been increased to be no lower than 300ft AMSL categorising them as a non-precision approach
- In parallel, the meteorological minima required to conduct an ILS instrument approach has been increased appropriately.
- An added element of the airfield ground lighting for the airport is the installation of Runway Threshold Identification Lights which have been installed for each runway.
- PAPI units have been installed on both sides of the runway in use
- Scheduled airline operators require specific training prior to operation into the airport. An online pilot briefing module aimed at foreign aircraft operators is also provided and highlighted when such operators apply to operate into the airport.

9.10.2 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located:

a) on that portion of a runway strip within:

1) 75 m of the runway centre line where the code number is 3 or 4; or
2) 45 m of the runway centre line where the code number is 1 or 2; or

b) on a runway end safety area, a taxiway strip or within the distances specified in Table 3-1; or

c) on a clearway and which would endanger an aircraft in the air;
shall be frangible and mounted as low as possible.

At NZWN, due to the geographical constraints of the airfield, the housing of the equipment required for the operation of the instrument landing system, has been sited below the level of the runway strip. In the instance of the glidepath antennae, this has been contained in an unground bunker (picture attached) and similarly for the localiser aerials where it is contained beneath the aerial array also (picture attached).

In addition, as commented upon during the online meeting, I have attached an extra photo of an instance where during an aircraft excursion from the runway, it came into contact with a hut used to contain equipment for the operation of a localiser which was not frangible.

Non frangible LLZ hut

NZWN – Heavy Sea Swell

WLZ – LLZ (Localizer) bunker

WLG - Glidepath Bunker

ZQN - EMAS

CERTIFICATION OF RWY 14R-32L FOR CODE 3C/4C AIRCRAFT OPERATIONS (A320/B737)
(OPSD) SKARDU INTERNATIONAL AIRPORT, PAKISTAN)
(CASE STUDY)

1. BACKGROUND

Skardu International Airport (OPSD), situated at an elevation of **7,301 ft AMSL**, is located in the northern region of Pakistan along the banks of the **Indus River** and is surrounded by high mountain terrain of the **Himalayan range**, with peaks exceeding **6,000 ft AMSL**. The challenging geographical and topographical environment imposes inherent operational constraints on the aerodrome. The airport is equipped with two (02) parallel runways, **14R–32L** and **14L–32R**. Runway **14R–32L** is primarily utilized for **Code 3C and limited Code 4C operations**. The declared distances for Runway 14R–32L are as follows:

- **TORA**: 3,657 m
- **TODA**: 3,657 m
- **LDA** : 3,657 m
- **ASDA**: 3,840 m

The **Runway End Safety Areas (RESA)** provided are:

- **RESA for RWY 32L**: 40 m × 80 m
- **RESA for RWY 14R**: 65 m × 140 m

Due to significant **geographical and topographical constraints**, including the presence of **sand dunes, ditches, and proximity to the Indus River**, the available RESA dimensions at both runway ends do not fully meet the **ICAO standard requirement of 90 m length and twice the runway width**. Furthermore, the **runway strip dimensions** do not fully comply with the applicable standards for **Code 3C/4C non instrument (VFR) operations**.

In order to ensure the continued safety of operations on Runway 14R–32L, the aerodrome operator conducted a **comprehensive safety assessment**, which was subsequently **reviewed and approved by the Pakistan Civil Aviation Authority (PCAA)**. The associated **risk assessment**, detailing identified hazards, mitigations, and residual risks, is provided in the subsequent section.

The approval was granted subject to **specific conditions**, which have been:

- Published in the **Aeronautical Information Publication (AIP)**,
- Incorporated into the **Aerodrome Manual**, and
- Integrated within the airport's **Safety Management System (SMS)** documentation.

PCAA inspection teams conduct **annual regulatory inspections** to verify the continued adequacy and effectiveness of the implemented mitigations. In addition, **Mandatory Occurrence Reporting (MOR) data** is continuously monitored to identify any adverse safety trends.

While a degree of **residual risk** remains due to unavoidable physical constraints, such risk has been **formally accepted by the regulator** on the basis that all approved mitigations and operational conditions remain fully implemented, effective, and subject to ongoing regulatory over

1. SAFETY ASSESSMENT FOR OPERATIONS OF A320/B737 ON RWY 14R-32L ON SKARDU INTERANTIONAL AIRPORT (OPSD);

S/N	Activity /Process	Hazard	Risk	Risk categorization	Existing defenses	Further defenses	Risk categorization after introduction of further defenses	Responsibility
1	Aircraft Operations at Runway 14R-32L	Aircraft landing and departures with insufficient strip and RESA	Reduced margins of safety during veer-off and over-shooting/undershooting (Aircrafts can hit sand dunes or fall into ravine (hundreds of feet deep)	3A	(i) Only VFR operations (non-instrument) are permitted at OPSD. (ii) Only rated (certified/special licensed) pilots for OPSD (Skardu international airport operations are allowed. (iii) Maintenance of runway surface so that minimum friction level is maintained. (iv) Effective GRF implementation. (v) Timely removal of rubber, snow, mud, sand and other contaminants. (vi) Restriction of VFR operations in tail wind and cross winds.(Tail wind limited to 10 Knots and Cross wind limited to 15 Knots)	(i) Additional Trainings of Airline pilots using advanced technology on use of RWY 14R-32L (ii) Grooving of Entire runway irrespective of friction for enhancement of friction. (iii) Introduction of advance technology at OPSD in birds hit mitigation hazard. (iv) Carrying out feasibility study for reducing the TORA (for making space for RESA at both ends) in consultation with Airlines.	2A	Aerodrome Operator Airline Operators

S/N	Activity /Process	Hazard	Risk	Risk categorization	Existing defenses	Further defenses	Risk categorization after introduction of further defenses	Responsibility
					(vii) Effective implementation of wildlife hazard management programme and plan at and around OPSD.			

As Far As **PRACTICABLE (AFAP)**[1] and As Low As **POSSIBLE (ALAP)**[2] Phrases in ICAO Annex 14 Volume I

Summary Table:

CH.	AFAPs in STD	ALAPs in STD	AFAPs in RP	ALAPs in RP	Total Numbers
3	3.4.3	-	3.1.19 3.4.6 3.4.14 3.4.16 3.5.4 3.5.6 3.5.7 3.5.10 3.5.11 3.8.4 3.11.6 3.13.2 3.14.2 3.15.7	3.1.2 3.1.4 3.9.5 3.9.10	AFAPs 15 (1 STD+14 RP) ALAPs 4 (0 STD + 4 RP)
4	-	(New OLS) 4.4.2 4.4.5	(New OLS) 4.4.6 (Old OLS) 4.2.5 4.2.12 4.2.21 4.2.27 4.4.1 4.4.2		AFAPs 7 (0 STD+7 RP) ALAPs 2 (2 STD + 0 RP)

[1] AFAP – This abbreviation is used to capture all SARPs where As Far As Practicable / Wherever Practicable, etc. phraseology has been used in Annex 14, Volume I.

[2] ALAP – This abbreviation is used to capture all SARPs where As Low As Possible / As Far As Possible / Wherever Possible, etc. phraseology has been used in Annex 14, Volume I.

CH.	AFAPs in STD	ALAPs in STD	AFAPs in RP	ALAPs in RP	Total Numbers
5	5.2.1.4 5.2.16.1 5.3.4.3 5.3.4.6 5.3.4.11 5.3.4.13 5.3.4.19 5.3.4.29 5.3.5.24 5.3.5.25 5.3.12.5 5.3.25.1 5.4.3.14	5.3.4.10 5.3.4.22 5.3.5.17 5.3.5.18 5.3.5.20 5.3.5.28 5.3.5.35 5.3.5.37 5.3.10.2 5.3.11.2 5.3.16.2 5.4.4.2	5.1.1.3 5.2.1.8 5.2.2.2 5.2.4.2 5.3.2.3 5.3.4.1 5.3.4.5 5.3.7.6 5.3.8.1 5.3.17.12 5.3.18.6 5.3.19.3 5.4.1.11 5.4.5.2 5.5.6.4	5.3.4.5 5.4.3.36	AFAPs 28 (13 STD+15 RP) ALAPs 14 (12 STD + 2 RP)
6	6.2.3.1 6.2.3.10 6.2.3.12 6.2.3.24 6.2.3.25 6.2.3.26 6.2.3.31 6.2.3.32 6.2.3.33		6.2.5.7 6.2.5.8		AFAPs 11 (9 STD+2 RP) ALAPs 0 (0 STD + 0 RP)
7	7.4.1.2	7.4.2.1 7.4.4.1		-	AFAPs 1 (1 STD+0 RP) ALAPs 2 (2 STD + 0 RP)
8		-	8.1.4		AFAPs 1 (0 STD+1 RP) ALAPs 0 (0 STD + 0 RP)
9	9.4.4	9.2.2		9.2.29	AFAPs 1 (1 STD+0 RP)

CH.	AFAPs in STD	ALAPs in STD	AFAPs in RP	ALAPs in RP	Total Numbers
		9.4.4 9.10.2 9.10.5		9.10.3 9.10.6	ALAPs 7 (4 STD + 3 RP)
10		10.3.1	10.5.4		AFAPs 1 (0 STD+1 RP) ALAPs 1 (1 STD + 0 RP)
	25	**21**	**40**	**9**	**AFAPs 65 (25 STD+40 RP)** **ALAPs 30 (21 STD + 9 RP)**

In Attachment-A

ATT-A	AFAPs	ALAPs	
	11.2.3 11.2.11 11.3.7 17.4.3 21.4 21.9 Table 5-2. b (Where practicable)	1.1.3 2.8 11.2.2 11.2.5 11.2.9 11.2.12 11.3.4 11.3.5 11.3.7 11.4.1 11.4.2 11.4.3 13. 21.1 21.2 21.7 Figure 5-19. e (as low as possible)	
	Total 6 nos.	**Total 16 nos.**	

Detailed Table (Showing AFAPs and ALAPs)

S.N.	Description of Clause	STD or RP
1	*3.1.2* ***Recommendation.****— The siting and orientation of runways at an aerodrome should, where possible, be such that the arrival and departure tracks minimize interference with areas approved for residential use and other noise-sensitive areas close to the aerodrome in order to avoid future noise problems.* *Note.— Guidance on how to address noise problems is provided in the Airport Planning Manual (Doc 9184), Part 2, and in Guidance on the Balanced Approach to Aircraft Noise Management (Doc 9829).*	**RP**
2	*3.1.4 Data to be used* ***Recommendation****.— The selection of data to be used for the calculation of the usability factor should be based on reliable wind distribution statistics that extend over as long a period as possible, preferably of not less than five years. The observations used should be made at least eight times daily and spaced at equal intervals of time.* *Note.— These winds are mean winds. Reference to the need for some allowance for gusty conditions is made in Attachment A, Section 1.*	**RP**
3	***Taxiway curves*** *3.9.5* ***Recommendation.****— Changes in direction of taxiways should be as few and small as possible. The radii of the curves should be compatible with the manoeuvring capability and normal taxiing speeds of the aeroplanes for which the taxiway is intended. The design of the curve should be such that, when the cockpit of the aeroplane remains over the taxiway centre line markings, the clearance distance between the outer main wheels of the aeroplane and the edge of the taxiway should not be less than those specified in 3.9.3.* *Note 1.— An example of widening taxiways to achieve the wheel clearance specified is illustrated in Figure 3-2. Guidance on the values of suitable dimensions is given in the Aerodrome Design Manual (Doc 9157), Part 2.* *Note 2.— The location of taxiway centre line markings and lights is specified in 5.2.8.6 and 5.3.17.12.* *Note 3.— Compound curves may reduce or eliminate the need for extra taxiway width.*	**RP**
	3.9.10 Sight distance ***Recommendation.****— Where a change in slope on a taxiway cannot be avoided, the change should be such that, from any point:* *— 3 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 300 m from that point, where the code letter is C, D, E or F;* *— 2 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 200 m from that point, where the code letter is B; and* *— 1.5 m above the taxiway, it will be possible to see the whole surface of the taxiway for a distance of at least 150 m from that point, where the code letter is A.*	**RP**
1	**3.1.19 Transverse slopes** ***Recommendation.****— To promote the most rapid drainage of water, the runway surface should, if practicable, be cambered except where a single crossfall from high to low in the direction of the wind most frequently associated with rain would ensure rapid drainage. The transverse slope should ideally be:* *— 1.5 per cent where the code letter is C, D, E or F; and* *— 2 per cent where the code letter is A or B;*	**RP**

S.N.	Description of Clause	STD or RP
	but in any event should not exceed 1.5 per cent or 2 per cent, as applicable, nor be less than 1 per cent except at runway or taxiway intersections where flatter slopes may be necessary. *For a cambered surface the transverse slope on each side of the centre line should be symmetrical.* *Note.— On wet runways with crosswind conditions the problem of aquaplaning from poor drainage is apt to be accentuated. Additional guidance is included in the Aerodrome Design Manual (Doc 9157), Parts 1 and 3.*	
2	**Width of runway strips** 3.4.3 A strip including a precision approach runway shall, wherever practicable, extend laterally to a distance of at least: — 140 m where the code number is 3 or 4; and — 70 m where the code number is 1 or 2; on each side of the centre line of the runway and its extended centre line throughout the length of the strip.	**STD**
3	**Objects on runway strips** *Note.— See 9.10 for information regarding siting of equipment and installations on runway strips.* *3.4.6* ***Recommendation.****— An object situated on a runway strip which may endanger aeroplanes should be regarded as an obstacle and should, as far as practicable, be removed.* *Note 1.— Consideration will have to be given to the location and design of drains on a runway strip to prevent damage to an aeroplane accidentally running off a runway. Suitably designed drain covers may be required. For further guidance, see the Aerodrome Design Manual (Doc 9157), Part 1.* *Note 2.— Where open-air or covered storm water conveyances are installed, consideration will have to be given to ensure that their structure does not extend above the surrounding ground so as not to be considered an obstacle. See also Note 1 to 3.4.16.* *Note 3.— Particular attention needs to be given to the design and maintenance of an open-air storm water conveyance in order to prevent wildlife attraction, notably birds. If needed, it can be covered by a net. Procedures on wildlife management are specified in the PANS-Aerodromes (Doc 9981). Further guidance can be found in the Airport Services Manual (Doc 9137), Part 3.*	**RP**
4	**3.4.14 Longitudinal slope changes** ***Recommendation.****— Slope changes on that portion of a strip to be graded should be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided.*	**RP**
5	**Transverse slopes** *3.4.16* ***Recommendation.****— The transverse slopes of any portion of a strip beyond that to be graded should not exceed an upward slope of 5 per cent as measured in the direction away from the runway.* *Note 1.— Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed in the non-graded portion of a runway strip and would be placed as far as practicable from the runway.* *Note 2.— The aerodrome rescue and firefighting (RFF) procedure would need to take into account the location of open- air water conveyances within the non-graded portion of a runway strip.*	**RP**
6	***Dimensions of runway end safety areas*** *3.5.4* ***Recommendation.****— A runway end safety area should, as far as practicable, extend from the end of a runway* *— 240 m where the code number is 3 or 4; or a reduced length when an arresting system is installed;* *— 120 m where the code number is 1 or 2 and the runway is an instrument one; or a reduced length when an arresting system is installed; and*	**RP**

S.N.	Description of Clause	STD or RP
	— 30 m where the code number is 1 or 2 and the runway is a non-instrument one.	
7	*3.5.6* ***Recommendation.****— The width of a runway end safety area should, wherever practicable, be equal to that of the graded portion of the associated runway strip.* *Note.— See 9.10 for information regarding siting of equipment and installations on runway end safety areas.*	**RP**
8	***Objects on runway end safety areas*** *3.5.7* ***Recommendation****.— An object situated on a runway end safety area which may endanger aeroplanes should be regarded as an obstacle and should, as far as practicable, be removed.*	**RP**
9	***3.5.10 Longitudinal slopes*** ***Recommendation****.— The longitudinal slopes of a runway end safety area should not exceed a downward slope of 5 per cent. Longitudinal slope changes should be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided.*	**RP**
10	*3.5.11 Transverse slopes* ***Recommendation****.— The transverse slopes of a runway end safety area should not exceed an upward or downward slope of 5 per cent. Transitions between differing slopes should be as gradual as practicable.*	**RP**
11	***3.8 Radio altimeter operating area*** ***Longitudinal slope changes*** *3.8.4* ***Recommendation****.— On a radio altimeter operating area, slope changes should be avoided or kept to a minimum. Where slope changes cannot be avoided, the slope changes should be as gradual as practicable and abrupt changes or sudden reversals of slopes avoided. The rate of change between two consecutive slopes should not exceed 2 per cent per 30 m.* *Note.— Guidance on radio altimeter operating area is given in Attachment A, Section 4.3, and in the Manual of All- Weather Operations, (Doc 9365), Section 5.2. Guidance on the use of radio altimeter is given in the PANS-OPS, Volume II, Part II, Section 1.*	**RP**
12	***Slopes on taxiway strips*** *3.11.6* ***Recommendation****.— The transverse slopes on any portion of a taxiway strip beyond that to be graded should not exceed an upward or downward slope of 5 per cent as measured in the direction away from the taxiway.* *Note 1.— Where deemed necessary for proper drainage, an open-air storm water conveyance may be allowed in the non- graded portion of a taxiway strip and would be placed as far as practicable from the taxiway.* *Note 2.— The aerodrome RFF procedure would need to take into account the location of open-air storm water conveyances within the non-graded portion of a taxiway strip.*	**RP**
13	***3.13 Aprons*** *3.13.2* ***Recommendation****.—The design of aprons should take into consideration criteria for safe ground handling, including:* *a) sufficient space between aircraft stands to enable personnel and equipment to move safely and efficiently;* *b) adequate apron markings, apron signs and apron floodlighting;* *c) adequate staging and storage areas for ground support equipment (GSE);* *d) positioning of fixed ground services;* *e) storage areas for unit load devices (ULD);* *f) adequate access and egress routes for fuel, GSE and emergency vehicles;*	**RP**

S.N.	Description of Clause	STD or RP
	g) clearly delineated and visible access and egress routes for passengers; *h) new technologies (electric charging points, autonomous vehicles, etc.);* *i) avoidance of rear of aircraft stand service roads wherever practicable; and* *j) appropriate protection for persons, equipment and infrastructure from jet blast and propeller wash.* *Note.— Further guidance on apron design and markings is given in the Aerodrome Design Manual (Doc 9157), Part 4 — Visual Aids, and the Airport Planning Manual (Doc 9184), Part 1— Master Planning.*	
14	***3.14 Isolated aircraft parking position*** *3.14.2* ***Recommendation****.— The isolated aircraft parking position should be located at the maximum distance practicable and in any case never less than 100 m from other parking positions, buildings or public areas, etc. Care should be taken to ensure that the position is not located over underground utilities such as gas and aviation fuel and, to the extent feasible, electrical or communication cables.*	**RP**
15	***Slopes on de-icing/anti-icing pads*** *3.15.7* ***Recommendation****.— The de-icing/anti-icing pads should be provided with suitable slopes to ensure satisfactory drainage of the area and to permit collection of all excess de-icing/anti-icing fluid running off an aeroplane. The maximum longitudinal slope should be as little as practicable and the transverse slope should not exceed 1 per cent.*	**RP**

S.N.	Description of Clause	STD or RP
16	***4.2 Obstacle limitation requirements*** ***Non-instrument runways*** *4.2.5* ***Recommendation.****— Existing objects above any of the surfaces required by 4.2.1 should as far as practicable be removed except when, in the opinion of the appropriate authority, the object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.* *Note.— Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger aeroplanes.*	**RP**
17	***Non-precision approach runways*** *4.2.12* ***Recommendation****.— Existing objects above any of the surfaces required by 4.2.7 should as far as practicable be removed except when, in the opinion of the appropriate authority, the object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.* *Note.— Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger aeroplanes.*	**RP**

S.N.	Description of Clause	STD or RP
18	***Precision approach runways*** *4.2.21* ***Recommendation.****— Existing objects above an approach surface, a transitional surface, the conical surface and inner horizontal surface should as far as practicable be removed except when, in the opinion of the appropriate authority, an object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.* *Note.— Because of transverse or longitudinal slopes on a strip, in certain cases the inner edge or portions of the inner edge of the approach surface may be below the corresponding elevation of the strip. It is not intended that the strip be graded to conform with the inner edge of the approach surface, nor is it intended that terrain or objects which are above the approach surface beyond the end of the strip, but below the level of the strip, be removed unless it is considered they may endanger aeroplanes.*	**RP**
19	***Runways meant for take-off*** *4.2.27* ***Recommendation****.— Existing objects that extend above a take-off climb surface should as far as practicable be removed except when, in the opinion of the appropriate authority, an object is shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes.* *Note.— Because of transverse slopes on a strip or clearway, in certain cases portions of the inner edge of the take-off climb surface may be below the corresponding elevation of the strip or clearway. It is not intended that the strip or clearway be graded to conform with the inner edge of the take-off climb surface, nor is it intended that terrain or objects which are above the take-off climb surface beyond the end of the strip or clearway, but below the level of the strip or clearway, be removed unless it is considered they may endanger aeroplanes. Similar considerations apply at the junction of a clearway and strip where differences in transverse slopes exist.*	**RP**
20	***4.4 Other objects*** *4.4.1* ***Recommendation.****— Objects which do not project through the approach surface but which would nevertheless adversely affect the optimum siting or performance of visual or non-visual aids should, as far as practicable, be removed.*	**RP**
21	*4.4.2* ***Recommendation.****— Anything which may, in the opinion of the appropriate authority after aeronautical study, endanger aeroplanes on the movement area or in the air within the limits of the inner horizontal and conical surfaces should be regarded as an obstacle and should be removed in so far as practicable.* *Note.— In certain circumstances, objects that do not project above any of the surfaces enumerated in 4.1 may constitute a hazard to aeroplanes as, for example, where there are one or more isolated objects in the vicinity of an aerodrome.*	**RP**
22	***CHAPTER 4. OBSTACLE RESTRICTION AND REMOVAL*** ***Applicable as of 21 November 2030*** ***4.4 Obstacle limitation requirements*** *4.4.6* ***Recommendation****.— Existing obstacles above the approach surface, and transitional surfaces or that complex surface extending between the lower edges of the transitional surfaces should as far as practicable be removed.*	**RP**
	4.4.2 Visual aids required for air navigation purposes or those fixed objects required for aircraft safety purposes and which project into the airspace above the inner approach surface, inner transitional surfaces and balked landing surface or that complex surface extending between the lower edges of the inner transitional surfaces shall be frangible and mounted as low as possible.	**ST**

S.N.	Description of Clause	STD or RP
	4.4.5 Equipment and installations required for air navigation or for aircraft safety purposes and which must project into the airspace above the approach surface and transitional surfaces or that complex surface extending between the lower edges of the transitional surfaces shall be frangible and mounted as low as possible.	**ST**

S.N.	Description of Clause	STD or RP
23	*5.1.1.3* ***Recommendation.—*** *The wind direction indicator should be in the form of a truncated cone made of fabric and should have a length of not less than 3.6 m and a diameter, at the larger end, of not less than 0.9 m. It should be constructed so that it gives a clear indication of the direction of the surface wind and a general indication of the wind speed. The colour or colours should be so selected as to make the wind direction indicator clearly visible and understandable from a height of at least 300 m, having regard to background. Where practicable, a single colour, preferably white or orange, should be used. Where a combination of two colours is required to give adequate conspicuity against changing backgrounds, they should preferably be orange and white, red and white, or black and white, and should be arranged in five alternate bands, the first and last bands being the darker colour.*	**RP**
	Colour and conspicuity 5.2.1.4 Runway markings shall be white. *Note 1.— It has been found that, on runway surfaces of light colour, the conspicuity of white markings can be improved by outlining them in black.* *Note 2.— It is preferable that the risk of uneven friction characteristics on markings be reduced in so far as practicable by the use of a suitable kind of paint.* *Note 3.— Markings may consist of solid areas or a series of longitudinal stripes providing an effect equivalent to the solid areas.*	**ST**
	Unpaved taxiways 5.2.1.8 **Recommendation.**— *An unpaved taxiway should be provided, so far as practicable, with the markings prescribed for paved taxiways.*	**RP**
	5.2.2.2 ***Recommendation.***— *A runway designation marking should be provided, so far as practicable, at the thresholds of an unpaved runway.*	**RP**
	5.2.4.2 ***Recommendation.***— *A threshold marking should be provided, so far as practicable, at the thresholds of an unpaved runway.* *Note.— The Aerodrome Design Manual (Doc 9157), Part 4, shows a form of marking which has been found satisfactory for the marking of downward slopes immediately before the threshold.*	**RP**
	5.2.16.1 Where it is impracticable to install a mandatory instruction sign in accordance with 5.4.2.1, a mandatory instruction marking shall be provided on the surface of the pavement.	**ST**
	5.3.2.3 ***Recommendation.***— *The colour of the emergency lights should conform to the colour requirements for runway lighting, except that, where the provision of coloured lights at the threshold and the runway end is not practicable, all lights may be variable white or as close to variable white as practicable.*	**RP**
	5.3.4 Approach lighting systems ***Application*** *5.3.4.1 Application* *A.— Non-instrument runway*	**RP**

S.N.	Description of Clause	STD or RP
	Recommendation.— *Where physically practicable, a simple approach lighting system as specified in 5.3.4.2 to 5.3.4.9 should be provided to serve a non-instrument runway where the code number is 3 or 4 and intended for use at night, except when the runway is used only in conditions of good visibility and sufficient guidance is provided by other visual aids.* *Note.— A simple approach lighting system can also provide visual guidance by day.* *B.— Non-precision approach runway* *Where physically practicable, a simple approach lighting system as specified in 5.3.4.2 to 5.3.4.9 shall be provided to serve a non-precision approach runway, except when the runway is used only in conditions of good visibility or sufficient guidance is provided by other visual aids.* *Note.— It is advisable to give consideration to the installation of a precision approach category I lighting system or to the addition of a runway lead-in lighting system.* *C.— Precision approach runway category I* *Where physically practicable, a precision approach category I lighting system as specified in 5.3.4.10 to 5.3.4.21 shall be provided to serve a precision approach runway category I.*	
	5.3.4.3 The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that, when a crossbar of 30 m is used, gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m. *Note 1.— Spacings for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and firefighting vehicles.* *Note 2.— See Attachment A, Section 11, for guidance on installation tolerances.*	**ST**
	5.3.4.5 ***Recommendation.—*** *If it is not physically possible to provide a centre line extending for a distance of 420 m from the threshold, it should be extended to 300 m so as to include the crossbar. If this is not possible, the centre line lights should be extended as far as practicable, and each centre line light should then consist of a barrette at least 3 m in length. Subject to the approach system having a crossbar at 300 m from the threshold, an additional crossbar may be provided at 150 m from the threshold.*	**RP**
	5.3.4.6 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that: a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within adistance of 60 m from the centre line of the system; and b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities)shall be screened from an approaching aircraft. Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.	**ST**
	5.3.4.10 A precision approach category I lighting system shall consist of a row of lights on the extended centre line of the runway extending, wherever possible, over a distance of 900 m from the runway threshold with a row of lights forming a crossbar 30 m in length at a distance of 300 m from the runway threshold. *Note.— The installation of an approach lighting system of less than 900 m in length may result in operational limitations on the use of the runway. See Attachment A, Section 11.*	**ST**

S.N.	Description of Clause	STD or RP
	5.3.4.11 The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m. *Note 1.— Spacings for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and firefighting vehicles.* *Note 2.— See Attachment A, Section 11, for guidance on installation tolerances.*	**ST**
	5.3.4.13 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that: a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft. Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.	**ST**
	5.3.4.19 If the centre line consists of lights as described in 5.3.4.14 a) or 5.3.4.15 a), additional crossbars of lights to the crossbar provided at 300 m from the threshold shall be provided at 150 m, 450 m, 600 m and 750 m from the threshold. The lights forming each crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m. *Note.— See Attachment A, Section 11, for detailed configuration.*	**ST**
	5.3.4.22 The approach lighting system shall consist of a row of lights on the extended centre line of the runway,extending, wherever possible, over a distance of 900 m from the runway threshold. In addition, the system shall have two side rows of lights, extending 270 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure 5-14. Where the serviceability level of the approach lights specified as maintenance objectives in 10.5.7 can be demonstrated, the system may have two side rows of lights, extending 240 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure 5-15. *Note.— The length of 900 m is based on providing guidance for operations under category I, II and III conditions. Reduced lengths may support category II and III operations but may impose limitations on category I operations. See Attachment A, Section 11.*	**ST**
	5.3.4.29 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that: a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft. Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.	**ST**
	5.3.5.17 The light units forming the wing bars, or the light units forming a fly-down or a fly-up matched pair, shall be mounted so as to appear to the pilot of an approaching aeroplane to be substantially in a horizontal line. The light units shall be mounted as low as possible and shall be frangible.	**ST**

S.N.	Description of Clause	STD or RP
	5.3.5.18 The light units shall be so designed that deposits of condensation, dirt, etc., on optically transmitting or reflecting surfaces shall interfere to the least possible extent with the light signals and shall in no way affect the elevation of the beams or the contrast between the red and white signals. The construction of the light units shall be such as to minimize the probability of the slots being wholly or partially blocked by snow or ice where these conditions are likely to be encountered.	**ST**
	5.3.5.20 When the runway on which a T-VASIS is provided is equipped with an ILS and/or MLS, the siting and elevations of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.	**ST**
	5.3.5.24 The PAPI system shall consist of a wing bar of four sharp transition multi-lamp (or paired single lamp) units equally spaced. The system shall be located on the left side of the runway unless it is physically impracticable to do so. *Note.— Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway.*	**ST**
	5.3.5.25 The APAPI system shall consist of a wing bar of two sharp transition multi-lamp (or paired single lamp) units. The system shall be located on the left side of the runway unless it is physically impracticable to do so. *Note.— Where a runway is used by aircraft requiring visual roll guidance which is not provided by other external means, then a second wing bar may be provided on the opposite side of the runway.*	**ST**
	5.3.5.28 The light units shall be located as in the basic configuration illustrated in Figure 5-19, subject to the installation tolerances given therein. The units forming a wing bar shall be mounted so as to appear to the pilot of an approaching aeroplane to be substantially in a horizontal line. The light units shall be mounted as low as possible and shall be frangible.	**ST**
	5.3.5.35 The light units shall be so designed that deposits of condensation, snow, ice, dirt, etc., on optically transmitting or reflecting surfaces shall interfere to the least possible extent with the light signals and shall not affect the contrast between the red and white signals and the elevation of the transition sector.	**ST**
	Figure 5-19. Siting of PAPI and APAPI e) To ensure that units are mounted as low as possible and to allow for any transverse slope, small height adjustments of up to 5 cm between units are acceptable. A lateral gradient not greater than 1.25 per cent can be accepted provided it is uniformly applied across the units.	**FIG**
	Table 5-2. Wheel clearance over threshold for PAPI and APAPI a. In selecting the eye-to-wheel height group, only aeroplanes meant to use the system on a regular basis shall be considered. The most demanding amongst such aeroplanes shall determine the eye-to-wheel height group. b. Where practicable the desired wheel clearances shown in column (2) shall be provided. c. The wheel clearances in column (2) may be reduced to no less than those in column (3) where an aeronautical study indicates that such reduced wheel clearances are acceptable. d. When a reduced wheel clearance is provided at a displaced threshold it shall be ensured that the corresponding desired wheel clearance specified in column (2) will be available when an aeroplane at the top end of the eye-to-wheel height group chosen overflies the extremity of the runway. e. This wheel clearance may be reduced to 1.5 m on runways used mainly by light-weight non-turbojet aeroplanes.	**Table**

S.N.	Description of Clause	STD or RP
	5.3.5.37 When the runway is equipped with an ILS and/or MLS, the siting and the angle of elevation of the light units shall be such that the visual approach slope conforms as closely as possible with the glide path of the ILS and/or the minimum glide path of the MLS, as appropriate.	**ST**
	5.3.7.6 ***Recommendation****.— Where practicable, the flashing lights in each group should flash in sequence towards the runway.*	**RP**
	5.3.8.1 ***Recommendation.****— Runway threshold identification lights should be installed:* *a) at the threshold of a non-precision approach runway when additional threshold conspicuity is necessary or where it is not practicable to provide other approach lighting aids; and* *b) where a runway threshold is permanently displaced from the runway extremity or temporarily displaced from the normal position and additional threshold conspicuity is necessary.*	**RP**
	5.3.10.2 When a threshold is at the extremity of a runway, the threshold lights shall be placed in a row at right angles to the runway axis as near to the extremity of the runway as possible and, in any case, not more than 3 m outside the extremity.	**ST**
	5.3.11.2 Runway end lights shall be placed on a line at right angles to the runway axis as near to the end of the runway as possible and, in any case, not more than 3 m outside the end.	**ST**
	5.3.12.5 Runway centre line lights shall be located along the centre line of the runway, except that the lights may be uniformly offset to the same side of the runway centre line by not more than 60 cm where it is not practicable to locate them along the centre line. The lights shall be located from the threshold to the end at longitudinal spacing of approximately 15 m. Where the serviceability level of the runway centre line lights specified as maintenance objectives in 10.5.7 or 10.5.11, as appropriate, can be demonstrated and the runway is intended for use in runway visual range conditions of 300 m or greater, the longitudinal spacing may be approximately 30 m. *Note.— Existing centre line lighting where lights are spaced at 7.5 m need not be replaced.*	**ST**
	5.3.16.2 Stopway lights shall be placed along the full length of the stopway and shall be in two parallel rows that are equidistant from the centre line and coincident with the rows of the runway edge lights. Stopway lights shall also be provided across the end of a stopway on a line at right angles to the stopway axis as near to the end of the stopway as possible and, in any case, not more than 3 m outside the end.	**ST**
	5.3.17.12 ***Recommendation.****— Taxiway centre line lights should normally be located on the taxiway centre line marking, except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.*	**RP**
	5.3.18.6 ***Recommendation.****— The lights should be located as near as practicable to the edges of the taxiway, runway turn pad, holding bay, de-icing/anti-icing facility, apron or runway, etc., or outside the edges at a distance of not more than 3 m.*	**RP**
	5.3.19.3 ***Recommendation.****— Runway turn pad lights should normally be located on the runway turn pad marking, except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.*	**RP**
	5.3.25.1 A visual docking guidance system shall be provided when it is intended to indicate, by a visual aid, the precise positioning of an aircraft on an aircraft stand and other alternative means, such as marshallers, are not practicable. *Note.— The factors to be considered in evaluating the need for a visual docking guidance system are in particular: the number and type(s) of aircraft using the aircraft stand, weather conditions, space available on the apron and the precision required for manoeuvring into the parking position due to aircraft servicing installation, passenger boarding bridges, etc. See the Aerodrome Design Manual (Doc 9157), Part 4 — Visual Aids for guidance on the selection of suitable systems.*	**ST**
	5.4.1.11 ***Recommendation.****— The time interval to change from one message to another on a variable message sign should be as short as practicable and should not exceed 5 seconds.*	**RP**

S.N.	Description of Clause	STD or RP
	5.4.3.14 Except as specified in 5.4.3.16 and 5.4.3.24 information signs shall, wherever practicable, be located on the left-hand side of the taxiway in accordance with Table 5-5.	**ST**
	5.4.3.36 ***Recommendation.****— When designating taxiways, the use of words such as "inner" and "outer" should be avoided wherever possible.*	**RP**
	5.4.4.2 A VOR aerodrome checkpoint sign shall be located as near as possible to the checkpoint and so that the inscriptions are visible from the cockpit of an aircraft properly positioned on the VOR aerodrome checkpoint marking.	**ST**
	5.4.5.2 ***Recommendation.****— The aerodrome identification sign should be placed on the aerodrome so as to be legible, in so far as is practicable, at all angles above the horizontal.*	**RP**
	5.5.6.4 ***Recommendation****.— Taxiway centre line markers should normally be located on the taxiway centre line marking except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.*	**RP**

S.N.	Description of Clause	STD or RP
	6.2.3.1 All fixed objects to be marked shall, whenever practicable, be coloured, but if this is not practicable, markers or flags shall be displayed on or above them, except that objects that are sufficiently conspicuous by their shape, size or colour need not be otherwise marked.	**ST**
	6.2.3.10 In the case of an object to be lighted, one or more low-, medium- or high-intensity obstacle lights shall be located as close as practicable to the top of the object. *Note.— Recommendations on how a combination of low-, medium- and/or high-intensity lights on obstacles should be displayed are given in Appendix 5.*	**ST**
	6.2.3.12 In the case of a tower or antenna structure indicated by high-intensity obstacle lights by day with an appurtenance, such as a rod or an antenna, greater than 12 m where it is not practicable to locate a high-intensity obstacle light on the top of the appurtenance, such a light shall be located at the highest practicable point and, if practicable, a medium-intensity obstacle light, Type A, mounted on the top.	**ST**
	6.2.3.24 Where an object is indicated by medium-intensity obstacle lights, Type A, and the top of the object is more than 105 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.	**ST**
	6.2.3.25 Where an object is indicated by medium-intensity obstacle lights, Type B, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and shall be spaced as equally as practicable between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.	**ST**
	6.2.3.26 Where an object is indicated by medium-intensity obstacle lights, Type C, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.	**ST**

S.N.	Description of Clause	STD or RP
	6.2.3.31 Where an object is indicated by medium-intensity obstacle lights, Type A, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.	**ST**
	6.2.3.32 Where an object is indicated by medium-intensity obstacle lights, Type B, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and shall be spaced as equally as practicable between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.	**ST**
	6.2.3.33 Where an object is indicated by medium-intensity obstacle lights, Type C, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.	**ST**
	6.2.5.7 ***Recommendation.****— When it has been determined that an overhead wire, cable, etc., needs to be marked but it is not practicable to install markers on the wire, cable, etc., then high-intensity obstacle lights, Type B, should be provided on their supporting towers.*	**RP**
	6.2.5.8 ***Recommendation.****— High-intensity obstacle lights, Type B, should be used to indicate the presence of a tower supporting overhead wires, cables, etc., where:* *a) an aeronautical study indicates such lights to be essential for the recognition of the presence of wires, cables, etc.; or* *b) it has not been found practicable to install markers on the wires, cables, etc.*	**RP**

S.N.	Description of Clause	STD or RP
	7.4.1.2 Where it is impracticable to install an unserviceability sign in accordance with 7.4.3.1, an unserviceability marking shall be provided on the surface of the pavement.	**ST**
	7.4.2.1 Unserviceability lights shall be provided on a movement area used at night, wherever any portion of the movement area is unfit for the movement of aircraft but it is still possible for aircraft to bypass the area safely. *Note 1.— Unserviceability lights are used for such purposes as warning pilots of a hole in a taxiway or apron pavement or outlining a portion of pavement, such as on an apron, that is under repair. They are not suitable for use when a portion of a runway becomes unserviceable, nor on a taxiway when a major portion of the width becomes unserviceable. In such instances, the runway or taxiway is normally closed.* *Note 2.— Procedures pertaining to the planning, coordination, monitoring and safety management of works in progress on the movement area are specified in the PANS-Aerodromes (Doc 9981).*	**ST**
	7.4.4.1 Unserviceability markers shall be displayed wherever any portion of a taxiway, apron or holding bay is unfit forthe movement of aircraft but it is still possible for aircraft to bypass the area safely. *Note.— Unserviceability markers are used for such purposes as warning pilots of a hole in a taxiway or apron pavement or outlining a portion of pavement, such as on an apron, that is under repair. They are not suitable for use when a portion of a runway becomes unserviceable, nor on a taxiway when a major portion of the width becomes unserviceable. In such instances, the runway or taxiway is normally closed.*	**ST**

	8.1.4 ***Recommendation.****— The time interval between failure of the primary source of power and the complete restoration of the services required by 8.1.10 should be as short as practicable, except that for visual aids associated with non-precision, precision approach or take-off runways the requirements of Table 8-1 for maximum switch-over times should apply.* *Note.— A definition of switch-over time is given in Chapter 1.*	**RP**

S.N.	Description of Clause	STD or RP
	9.2.2 Where an aerodrome is located close to water/swampy areas, or difficult terrain, and where a significant portion of approach or departure operations takes place over these areas, specialist rescue services and firefighting equipment appropriate to the hazard and risk shall be available. *Note 1.— Special firefighting equipment need not be provided for water areas; this does not prevent the provision of such equipment if it would be of practical use, such as when the areas concerned include reefs or islands.* *Note 2.— The objective is to plan and deploy the necessary life-saving flotation equipment as expeditiously as possible in a number commensurate with the largest aeroplane normally using the aerodrome.* *Note 3.— Additional guidance is available in Chapter 13 of the Airport Services Manual (Doc 9137), Part 1.*	**ST**
	9.2.29 ***Recommendation.*** *— To meet the operational objective as nearly as possible in less than optimum conditions of visibility, especially during low visibility operations, suitable guidance, equipment and/or procedures for rescue and firefighting services should be provided.* *Note.— Additional guidance is available in the Airport Services Manual (Doc 9137), Part 1.*	**RP**
	9.4.4 The appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.	**ST**
	9.10.2 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located: a) on that portion of a runway strip within: 1) 75 m of the runway centre line where the code number is 3 or 4; or 2) 45 m of the runway centre line where the code number is 1 or 2; or b) on a runway end safety area, a taxiway strip or within the distances specified in Table 3-1; or c) on a clearway and which would endanger an aircraft in the air; shall be frangible and mounted as low as possible.	**ST**
	9.10.3 ***Recommendation.****— Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on the non-graded portion of a runway strip should be regarded as an obstacle and should be frangible and mounted as low as possible.* *Note.— Guidance on the siting of navigation aids is contained in the Aerodrome Design Manual (Doc 9157), Part 6.*	**RP**
	9.10.5 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on or near a strip of a precision approach runway category I, II or III and which: a) is situated within 240 m from the end of the strip and within: 1) 60 m of the extended runway centre line where the code number is 3 or 4; or 2) 45 m of the extended runway centre line where the code number is 1 or 2; or	**ST**

S.N.	Description of Clause	STD or RP
	b) penetrates the inner approach surface, the inner transitional surface or the balked landing surface; shall be frangible and mounted as low as possible.	
	9.10.6 ***Recommendation****.— Any equipment or installation required for air navigation or for aircraft safety purposes which is an obstacle of operational significance in accordance with 4.2.4, 4.2.11, 4.2.20 or 4.2.27 should be frangible and mounted as low as possible.*	**RP**

S.N.	Description of Clause	STD or RP
	10.3.1 Snow, slush, ice, standing water, mud, dust, sand, oil, rubber deposits and other contaminants shall be removed from the surface of runways in use as rapidly and completely as possible to minimize accumulation. *Note.— The above requirement does not imply that winter operations on compacted snow and ice are prohibited. Information on snow removal and ice control and removal of other contaminants is given in the PANS-Aerodromes (Doc 9981).*	**ST**
	10.5.4 ***Recommendation.****— In-field measurement of intensity, beam spread and orientation of lights included in approach and runway lighting systems for a precision approach runway category II or III should be undertaken by measuring all lights, as far as practicable, to ensure conformance with the applicable specification of Appendix 2.*	**RP**

S.N.	Description of Clause	STD or RP
	1.1.3 Topography of the aerodrome site, its approaches, and surroundings, particularly: a) compliance with the obstacle limitation surfaces; b) current and future land use. The orientation and layout should be selected so as to protect as far as possible the particularly sensitive areas such as residential, school and hospital zones from the discomfort caused by aircraft noise. Detailed information on this topic is provided in the Airport Planning Manual (Doc 9184), Part 2, and in Guidance on the Balanced Approach to Aircraft Noise Management (Doc 9829);	**ATT-A**
	2.8 The minimum runway length and the maximum stopway or clearway length to be provided may be determined as follows, from the data in the aeroplane flight manual for the aeroplane considered to be critical from the viewpoint of runway length requirements: a) if a stopway is economically possible, the lengths to be provided are those for the balanced field length. The runway length is the take-off run required or the landing distance required, whichever is the greater. If the accelerate-stop distance required is greater than the runway length so determined, the excess may be provided as stopway, usually at each end of the runway. In addition, a clearway of the same length as the stopway must also be provided;	**ATT-A**
	11.2.2 The centre line of an approach lighting system should be as coincident as possible with the extended centre line of the runway with a maximum tolerance of ±15'.	**ATT-A**
	11.2.3 The longitudinal spacing of the centre line lights should be such that one light (or group of lights) is located in the centre of each crossbar, and the intervening centre line lights are spaced as evenly as practicable between two crossbars or a crossbar and a threshold.	**ATT-A**
	11.2.5 When a crossbar has to be displaced from its standard position, any adjacent crossbar should, where possible, be displaced by appropriate amounts in order to reduce the differences in the crossbar spacing.	**ATT-A**

S.N.	Description of Clause	STD or RP
	11.2.9 It is desirable that the lights be mounted so that, as far as possible, no object within a distance of 60 m on each side of the centre line protrudes through the plane of the approach lighting system. Where a tall object exists within 60 m of the centre line and within 1 350 m from the threshold for a precision approach lighting system, or 900 m for a simple approach lighting system, it may be advisable to install the lights so that the plane of the outer half of the pattern clears the top of the object.	**ATT-A**
	11.2.11 Centre line. The gradients of the centre line in any section (including a stopway or clearway) should be as small as practicable, and the changes in gradients should be as few and small as can be arranged and should not exceed 1 in 60. Experience has shown that as one proceeds outwards from the runway, rising gradients in any section of up to 1 in 66, and falling gradients of down to 1 in 40, are acceptable.	**ATT-A**
	11.2.12 Crossbars. The crossbar lights should be so arranged as to lie on a straight line passing through the associated centre line lights, and wherever possible this line should be horizontal. It is permissible, however, to mount the lights on a transverse gradient not more than 1 in 80, if this enables crossbar lights within a stopway or clearway to be mounted nearer to the ground on sites where there is a cross-fall.	**ATT-A**
	11.3.4 Where an ILS localizer is installed within the light plane boundaries, it is recognized that the localizer, or screen if used, must extend above the light plane. In such cases the height of these structures should be held to a minimum and they should be located as far from the threshold as possible. In general the rule regarding permissible heights is 15 cm for each 30 m the structure is located from the threshold. As an example, if the localizer is located 300 m from the threshold, the screen will be permitted to extend above the plane of the approach lighting system by 10 × 15 = 150 cm maximum, but preferably should be kept as low as possible consistent with proper operation of the ILS.	**ATT-A**
	11.3.5 In locating an MLS azimuth antenna the guidance contained in Annex 10, Volume I, Attachment G, should be followed. This material, which also provides guidance on collocating an MLS azimuth antenna with an ILS localizer antenna, suggests that the MLS azimuth antenna may be sited within the light plane boundaries where it is not possible or practical to locate it beyond the outer end of the approach lighting for the opposite direction of approach. If the MLS azimuth antenna is located on the extended centre line of the runway, it should be as far as possible from the closest light position to the MLS azimuth antenna in the direction of the runway end. Furthermore, the MLS azimuth antenna phase centre should be at least 0.3 m above the light centre of the light position closest to the MLS azimuth antenna in the direction of the runway end. (This could be relaxed to 0.15 m if the site is otherwise free of significant multipath problems.) Compliance with this requirement, which is intended to ensure that the MLS signal quality is not affected by the approach lighting system, could result in the partial obstruction of the lighting system by the MLS azimuth antenna. To ensure that the resulting obstruction does not degrade visual guidance beyond an acceptable level, the MLS azimuth antenna should not be located closer to the runway end than 300 m and the preferred location is 25 m beyond the 300 m crossbar (this would place the antenna 5 m behind the light position 330 m from the runway end). Where an MLS azimuth antenna is so located, a central part of the 300 m crossbar of the approach lighting system would alone be partially obstructed. Nevertheless, it is important to ensure that the unobstructed lights of the crossbar remain serviceable all the time.	**ATT-A**
	11.3.7 In some instances objects may exist which cannot be removed, lowered or relocated economically. These objects may be located so close to the threshold that they cannot be cleared by the 2 per cent slope. Where such conditions exist and no alternative is possible, the 2 per cent slope may be exceeded or a “stair step” resorted to in order to keep the approach lights above the objects. Such “step” or increased gradients should be resorted to only when it is impracticable to follow standard slope criteria, and they should be held to the absolute minimum. Under this criterion no negative slope is permitted in the outermost portion of the system.	**ATT-A**
	11.4.1 The need for an adequate approach lighting system to support precision approaches where the pilot is required to acquire visual references prior to landing cannot be stressed too strongly. The safety and regularity of such operations is dependent on this visual acquisition. The height	**ATT-A**

S.N.	Description of Clause	STD or RP
	above runway threshold at which the pilot decides there are sufficient visual cues to continue the precision approach and land will vary, depending on the type of approach being conducted and other factors such as meteorological conditions, ground and airborne equipment, etc. The required length of approach lighting system which will support all the variations of such approaches is 900 m, and this shall always be provided whenever possible.	
	11.4.2 However, there are some runway locations where it is impossible to provide the 900 m length of approach lighting system to support precision approaches.	
	11.4.3 In such cases, every effort should be made to provide as much approach lighting system as possible. The appropriate authority may impose restrictions on operations to runways equipped with reduced lengths of lighting. There are many factors which determine at what height the pilot must have decided to continue the approach to land or execute a missed approach. It must be understood that the pilot does not make an instantaneous judgement upon reaching a specified height. The actual decision to continue the approach and landing sequence is an accumulative process which is only concluded at the specified height. Unless lights are available prior to reaching the decision point, the visual assessment process is impaired and the likelihood of missed approaches will increase substantially. There are many operational considerations which must be taken into account by the appropriate authorities in deciding if any restrictions are necessary to any precision approach and these are detailed in Annex 6.	**ATT-A**
	13. Lighting of unserviceable areas Where a temporarily unserviceable area exists, it may be marked with fixed-red lights. These lights should mark the most potentially dangerous extremities of the area. A minimum of four such lights should be used, except where the area is triangular in shape where a minimum of three lights may be employed. The number of lights should be increased when the area is large or of unusual configuration. At least one light should be installed for each 7.5 m of peripheral distance of the area. If the lights are directional, they should be orientated so that as far as possible their beams are aligned in the direction from which aircraft or vehicles will approach. Where aircraft or vehicles will normally approach from several directions, consideration should be given to adding extra lights or using omnidirectional lights to show the area from these directions. Unserviceable area lights should be frangible. Their height should be sufficiently low to preserve clearance for propellers and for engine pods of jet aircraft.	**ATT-A**
	17.4.3 At an aerodrome bordering the water, the boats or other vehicles should preferably be located on the aerodrome, and convenient launching or docking sites provided. If these vehicles are located off the aerodrome, they should preferably be under the control of the aerodrome rescue and firefighting service or, if this is not practicable, under the control of another competent public or private organization working in close coordination with the aerodrome rescue and firefighting service (such as police, military services, harbour patrol or coast guard).	**ATT-A**
	21.1 Good aerodrome design practices can reduce the potential for runway incursions while maintaining operating efficiency and capacity. The following taxiway design guidance may be considered to be part of a runway incursion prevention programme as a means to ensure that runway incursion aspects are addressed during the design phase for new runways and taxiways. Within this focused guidance, the prime considerations are to limit the number of aircraft or vehicles entering or crossing a runway, provide pilots with enhanced unobstructed views of the entire runway, and correct taxiways identified as hot spots as much as possible.	**ATT-A**
	21.2 The centre line of an entrance taxiway should be perpendicular to the runway centre line, where possible. This design principle provides pilots with an unobstructed view of the entire runway, in both directions, to confirm that the runway and approach are clear of conflicting traffic before proceeding towards the runway. Where the taxiway angle is such that a clear unobstructed view, in both directions, is not possible,	**ATT-A**

S.N.	Description of Clause	STD or RP
	consideration should be given to providing a perpendicular portion of the taxiway immediately adjacent to the runway to allow for a full visual scan by the pilots prior to entering or crossing a runway.	
	21.4 Existing taxiways wider than recommended in this Annex, can be rectified by painting taxi side stripe markings to the recommended width. As far as practicable, it is preferable to redesign such locations properly rather than to repaint such locations.	**ATT-A**
	21.7 If possible, avoid building taxiways that enter at the mid-runway location. This design principle helps to reduce the collision risks at the most hazardous locations (high energy location) because normally departing aircraft have too much energy to stop, but not enough speed to take-off, before colliding with another errant aircraft or vehicle.	
	21.9 Avoid the placement of different pavement materials (asphalt and cement concrete) at or near the vicinity of the runway holding position, as far as practicable. This design principle avoids creating visual confusion as to the actual location of the runway holding position.	**ATT-A**