Aerodromes to be listed in Asia Pacific Air Navigation Plan [26 January 2022]

Serial #	Sub-region	State / Admin	ICAO Code	Name of City	Name of Aerodrome	Type	APAC ANP
1	SA	Afghanistan	OAHR	Herat	Herat Intl	UNK	0
4	SA	Afghanistan	OAMS	Mazar-e-Sharif	Mazar-e-Sharif	UNK	0
44	SEA	Cambodia	VDSV	Sihanouk	Sihanouk Intl	UNK	0
45	NA	China	ZBOW	Baotou		UNK	0
46	NA	China	ZGBH	Beihai		UNK	0
48	NA	China	ZBAD	Beijing	Daxing	UNK	0
49	NA	China	ZYCC	Changchun	Longjia	UNK	0
51	NA	China	ZSCG	Changzhou	Benniu	UNK	0
55	NA	China	ZLDH	Dunhuang		UNK	0
56	NA	China	ZHES	Enshi	Xujiaping	UNK	0
58	NA	China	ZSGZ	Ganzhou	Huangjin	UNK	0
62	NA	China	ZUGY	Guiyang	Longdongbao	UNK	0
63	NA	China	ZBLA	Hulunbeier	Hailar	UNK	0
64	NA	China	ZJHK	Haikou	Meilan	UNK	0
69	NA	China	ZWTN	Hotan		UNK	0
70	NA	China	ZSSH	Huai'an	Lianshui	UNK	0
71	NA	China	RCYU	Hualien	Hualien	UNK	0
72	NA	China	ZSTX	Huangshan	Tunxi	UNK	0
73	NA	China	ZYJM	Jiamusi		UNK	0
74	NA	China	ZGOW	Jieyang	Chaoshan	UNK	0
79	NA	China	ZULS	Lhasa	Gonggar	UNK	0
80	NA	China	ZSLG	Lianyungang	Baitabu	UNK	0
81	NA	China	ZPLJ	Lijiang	Sanyi	UNK	0
82	NA	China	ZSLY	Linyi	Shubuling	UNK	0
83	NA	China	ZHLY	Luoyang	Beijiao	UNK	0
84	NA	China	ZPMS	Dehong	Mangshi	UNK	0
85	NA	China	ZBMZ	Manzhouli	Xijiao	UNK	0
86	NA	China	ZYMD	Mudanjiang	Hailang	UNK	0
87	NA	China	ZSCN	Nanchang	Changbei	UNK	0
90	NA	China	ZSNT	Nantong	Xingdong	UNK	0
91	NA	China	ZSNB	Ningbo	Lishe	UNK	0
92	NA	China	ZBDS	Ordos	Ejin Horo	UNK	0
94	NA	China	ZYQQ	Qiqihar	Sanjiazi	UNK	0
95	NA	China	ZSQZ	Quanzhou	Jinjiang	UNK	0
101	NA	China	ZBSJ	Shijiazhuang	Zhengding	UNK	0
104	NA	China	RCMQ	Taichung	Cingcyuangang	UNK	0
105	NA	China	RCNN	Tainan	Tainan	UNK	0
109	NA	China	ZSWH	Weihai	Dashuipo	UNK	0

Serial #	Sub-region	State / Admin	ICAO Code	Name of City	Name of Aerodrome	Type	APAC ANP
110	NA	China	ZSWZ	Wenzhou	Longwan	UNK	0
112	NA	China	ZSWX	Wuxi	Shuofang	UNK	0
113	NA	China	ZSWY	Wuyishan		UNK	0
117	NA	China	ZLXN	Xining	Caojiabao	UNK	0
118	NA	China	ZPJH	Xishuangbanna	Gasa	UNK	0
119	NA	China	ZSXZ	Xuzhou	Guanyin	UNK	0
120	NA	China	ZSYN	Yancheng	Nanyang	UNK	0
121	NA	China	ZYYJ	Yanji	Chaoyangchuan	UNK	0
122	NA	China	ZSYT	Yantai	Penglai	UNK	0
123	NA	China	ZSYA	Yangzhou	Taizhou	UNK	0
124	NA	China	ZHYC	Yichang	Sanxia	UNK	0
125	NA	China	ZLIC	Yinchuan	Hedong	UNK	0
126	NA	China	ZSYW	Yiwu		UNK	0
127	NA	China	ZGZJ	Zhanjiang		UNK	0
128	NA	China	ZGDY	Zhangjiajie	Hehua	UNK	0
129	NA	China	ZHCC	Zhengzhou	Xinzheng	UNK	0
130	NA	China	ZSZS	Zhoushan	Putuoshan	UNK	0
131	NA	China	ZUZY	Zunyi	Xinzhou	UNK	0
133	PAC	Cook Islands	NCAI	Aitutaki		UNK	0
144	SA	India	VEBS	Bhubaneswar		UNK	0
146	SA	India	VICG	Chandigarh		UNK	0
151	SA	India	VOGO	Goa		UNK	0
162	SA	India	VOPB	Port Blair		UNK	0
163	SA	India	VAPO	Pune		UNK	0
164	SA	India	VISR	Srinagar		UNK	0
202	NA	Japan	RJSA	Aomori		UNK	0
203	NA	Japan	RJEC	Asahikawa		UNK	0
205	NA	Japan	RJSF	Fukushima		UNK	0
207	NA	Japan	RJSI	Hanamaki		UNK	0
209	NA	Japan	RJAH	Hyakuri		UNK	0
210	NA	Japan	ROIG	Ishigaki	New Ishigaki	UNK	0
213	NA	Japan	RJFR	Kitakyushu		UNK	0
214	NA	Japan	RJNK	Komatsu		UNK	0
216	NA	Japan	RJFM	Miyazaki		UNK	0
224	NA	Japan	RJFS	Saga		UNK	0
226	NA	Japan	RJCO	Sapporo	Sapporo	MIL	0
228	NA	Japan	RORS	Shimojishima		UNK	0

Serial #	Sub-region	State / Admin	ICAO Code	Name of City	Name of Aerodrome	Type	APAC ANP
229	NA	Japan	RJNS	Shizuoka		UNK	0
231	NA	Japan	RJOS	Tokushima		UNK	0
234	NA	Japan	RJNT	Toyama		UNK	0
235	NA	Japan	RJOH	Yonago	Miho	UNK	0
269	PAC	Micronesia	PTSA	Kosrae I.	Kosrae	UNK	0
270	NA	Mongolia	ZMCD	Dornod	Choibalsan	UNK	0
292	PAC	N. Mariana Is.	PGWT	Tinian I.	West Tinian	UNK	0
326	PAC	Solomon Islands	AGGM	Munda		UNK	0
330	SA	Sri Lanka	VCCJ	Jaffna		UNK	0
350	SEA	Viet Nam	VVDL	Da Lat	Lien Khuong	UNK	0

Notes:

Australia: Need to finalize the Table AOP II -1, APAC ANP V-II.

New Zealand: Need to finalize the Table AOP II -1, APAC ANP V-II.

US

1) Tinian I./West Tinian [PGWT] for N. Mariana Is. should be added in Table AOP I – 1 of APAC ANP V - I and Table AOP II – 1 of APAC ANP V - II.
2) JOHNSTON ATOLL/Johnston I (PJON) should be withdrawn from Table AOP I – 1 of APAC ANP V - I and Table AOP II – 1 of APAC ANP V - II as it had been permanently closed.

INTERNATIONAL CIVIL AVIATION ORGANIZATION

REGIONAL GUIDANCE FOR THE DESIGN AND OPERATION OF ALTIPORTS

[DRAFT]

First Edition, ../../ 2022

This Guidance Material was developed by AP-ADO/WG and approved by the AOP/SG/.. Meeting and published by ICAO Asia and Pacific Office, Bangkok

RECORD OF AMENDMENTS

AMENDMENTS				AMENDMENTS			
No.	Date Applicable	Date Entered	Entered by:	No.	Date Applicable	Date Entered	Entered by:

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CHAPTER 1. GENERAL

1.1 Introduction

1.1.1 This regional guidance material provides general guidance on altiports site selection, physical characteristics, obstacle limitation surfaces and visual aids that should be provided at altiports, as well as certain facilities and technical services normally provided at conventional land aerodromes.

1.1.2 Stolport Manual (Doc 9150) defines an ALTIPORT as "a small airport in a mountainous area with a steep gradient runway, used for landing up the slope and for take-off down the slope, thereby making use of only one approach/departure area." (FOREWORD, para 4 refers)

1.1.3 Most of the Annex-14 Volume - I and Stolport specifications may not be applicable to altiports which are constructed in mountainous regions, though some of the STOL aeroplanes in use today are designed to operate from altiports.

1.1.4 As no standards and recommended practices (SARPs) for altiports exist in any of the ICAO documents, this guidance material covers all the aircraft operating aspects of altiports except non-visual navigation aids. The airport terminal building and ground side operations are not addressed.

1.1.5 Since altiports are generally operated under visual meteorological conditions (VMC), the provisions described below are limited to this type of operation:

a) an altiport has at least:

- a steeply sloped runway extended at the top by a low-sloped section, itself associated with a substantially horizontal platform comprising the waiting and parking areas, and
- a unique approach and take-off corridor, which itself is supported by the lower end of the runway strip.

b) The lower part of the steep slope of the runway can be usefully extended by a section of less steep slope[1] allowing the pilot:

- to make contact more comfortable on landing,
- to have a better view of the end of the runway during the take-off roll prior to take-off,
- to limit the length of runway required for an accelerate-stop distance available in the case of an engine failure during take-off [2].

c) The design of an altiport is based on the idea that, since take-off is downhill and landing is uphill, the steep section of the runway is used as an additional factor of acceleration on take-off and deceleration on landing to reduce the lengths required for both.

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1 *nevertheless, higher than the maximums retained for the runways of conventional aerodromes.*

2 *minimum requirement for multi-engine aeroplanes carrying more than ten passengers or having a maximum take-off mass of 5,700 kg or less.*

1.2 Altiport design aeroplanes

1.2.1 For the purposes of this guidance material, the altiport design aeroplane is assumed to be an aeroplane with short take-off landing (STOL) performances that has a reference field length of 800 m or less. In size, the altiport design aeroplane is assumed to have a wingspan of up to 24 m (aerodrome reference code B) and an outer main gear wheel span (OMGWS) of up to 6 m. In terms of aeroplane mass, the design aeroplane is assumed to have a maximum take-off mass of 5,700 kg or less [determine later after having more information on take-off mass of critical altiport design aeroplane].

1.2.2 List of aeroplanes currently operated at altiports in Indonesia and Nepal and aeroplanes with STOL performance suitable for operations at altiports are provided in **Appendix 1**.

1.3 Definitions

[To be developed]

Refer to *Annex 14 Aerodromes, Volume I Aerodrome Design and Operations* for definitions of terms used for land aerodromes.

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

Aerodrome for conventional take-off and landing (conventional aerodrome). ……

Altiport. A small airport in a mountainous area with a steep gradient runway, used for landing up the slope and for take-off down the slope, thereby making use of only one approach/departure area.

Stolport. An airport whose physical characteristics, visual and non-visual aids and total infrastructure are created to support safe and effective public air transport in and out of densely populated urban areas as well as to and from rural areas with difficult terrain.

……………

1.4 Applicability

1.4.1 This guidance material is meant for the use of altiport planners and the appropriate airport authorities in examining the feasibility of altiport operations at existing aerodromes or other sites and in the planning, design and approval of altiports. Interpretation of the material requires the exercise of discretion and the making of decisions, particularly by the airport authorities.

1.5 Site Selection

1.5.1 Before a commitment of resources is made to establish an altiport or system of altiports in a mountainous area, there should be recognized social, environmental, economic, and operational advantages over existing transportation systems. These advantages hinge on the potential of greatly reducing trip time by providing service from urban areas to remote mountainous area.

1.5.2 The short runway of an altiport, the requirement for less airspace in the terminal area than needed by conventional air transport and the practicality of steep obstacle limitation surfaces allow greater flexibility in locating the site

1.5.3 Once an altiport site is provisionally selected, planning authorities will have to consider the details of construction and application of altiport specifications. This consideration might include a series of demonstration flights. The flights would serve several purposes. The community would be reassured about the safety and compatibility of altiport operations; the effects of air turbulence caused by hills could be tested; and route structures and air traffic service (ATS) separation standards could be established.

1.5.4 At the same time, the site would be examined with respect to the provision/or availability of ground transportation up to the nearest possible location from the feasible altiport site, without which some advantage is lost. Another important consideration governing site selection is the nature and composition of the soil and subsoil upon which prepared surfaces will be supported and, in particular, the adequacy of drainage to prevent the erosion of surfaces. Detailed guidance on airport site evaluation and selection is given in the *Airport Planning Manual (Doc 9184), Part 1 – Master Planning*.

1.5.5 Lastly, having established an altiport location, planners will turn to the design using the descriptions provided in this manual to define the physical characteristics, obstacle limitation surfaces and visual aids. This guidance is contained in the following chapter.

CHAPTER 2. ALTIPORT DATA

2.1 General

2.1.1 *Annex 14, Volume I, Chapter 2* sets forth details of aerodrome data to be determined about aerodromes and reported to the appropriate aeronautical information services (AIS). Where applicable, these requirements should be met for an altiport.

2.1.2 Where the use of an altiport is restricted to a particular aeroplane type, the appropriate aeronautical information service should be informed.

2.1.3 Specifications on the manner in which altiport data should be reported are prescribed in *Annexes 4* and *15* and *PANS-AIM (Doc 10066)*.

CHAPTER 3. PHYSICAL CHARACTERISTICS

3.1 General

3.1.1 The planning of an altiport comprises the development of suitable physical characteristics to provide the necessary operating elements for service by the altiport design aeroplanes. In addition, capacity or the forecast rate of utilization should be considered by the planner. The maximum rate of use is dependent on such factors as demand, weather and air traffic control capabilities as much as on altiport features. Although the characteristics described in this chapter are meant only to provide safe and effective field lengths and clearances, it is likely, in light of such external factors, that an altiport whose physical characteristics conform to this chapter could handle any forecast frequency of service.

3.2 Runways

3.2.1 Orientation of runway

3.2.1.1 This guidance material is developed for design and operations of altiport to be used only in visual meteorological conditions, and intended for use by day only.

3.2.1.2 It is anticipated that the configuration for most altiports would be a single runway in which operations are restricted to landing uphill and taking off downhill and an associated parking area. (Figure 3-1).

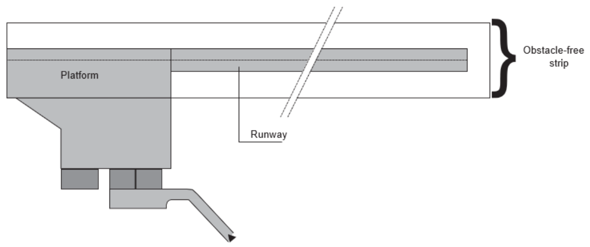

Figure 3 – 1: Schematic diagram of an altiport with paved runway

3.2.1.3 An altiport sites may lessen the opportunity for an ideal runway orientation in the direction of the prevailing wind due to topography of the site. Nevertheless, altiport design should aim for maximum usability factor and the orientation of the runway should take into account of crosswind limitation of the design aeroplane. Guidance on factors to be taken into account in the study of wind distribution is given in *Annex 14, Volume I, Attachment A, Section 1*.

3.2.1.4 The decision on runway orientation should also take into account areas over which traffic will operate on approach, missed approach and departure so that obstructions in these areas or other factors will not unduly restrict operations.

3.2.2 Runway length

3.2.2.1 The length of an altiport runway should be determined using take-off and landing performance charts obtained from the aeroplane flight manual of the altiport design aeroplane and considered together with the following factors:

a) whether the approaches are open or restricted;

b) longitudinal slope of the proposed runway;

c) elevation of the site;

d) temperature and humidity of the site; and

e) nature of the runway surface.

3.2.2.2 When the appropriate aeroplane flight manual is not available the length of an altiport runway may be determined as described in **Section 1 of Attachment A**.

3.2.3 Stopways and clearways

3.2.3.1 Where a stopway or clearway is provided, an actual runway length less than that suggested by 3.2.2.1 may be considered satisfactory. In such a case any combination of runway, stopway and clearway should meet the take-off and landing requirements of the altiport design aeroplane, taking into consideration the same factors as in 3.2.2.1. The guidance on the use of stopways and clearways given in *Annex 14, Volume I, Attachment A, Section 2,* is applicable to altiports.

3.2.4 Runway width

3.2.4.1 Detailed guidance for determination of runway width for altiport is provided in **Section 2 of Attachment A**.

3.2.4.2 For paved runways, the absolute minimum width of 18 m is recommended for use in visual meteorological conditions and intended for use by day only.

3.2.4.3 For unpaved runways, the minimum width of the runway should be at least the width of the graded portion of the runway strip or 50 m.

3.2.4.4 The site selection and orientation of a runway in the mountains is generally quite constrained, so particular attention must be paid to crosswinds in determining the width of the runway beyond the minimums thus recommended above.

3.2.5 Slopes on runways

Longitudinal slopes of the runway

3.2.5.1 In longitudinal profile, for the section with steep slope, the maximum average value of longitudinal slope should not exceed 20 per cent and along no portion of that section the longitudinal slope should not exceed 25%.

3.2.5.2 Longitudinal slope of the upper portion (the first quarter of the length of the runway) of the runway should not exceed 3 per cent.

3.2.5.3 Longitudinal slope of the lower portion of the runway (the last quarter of the length of the runway) should not exceed ??? (2 per cent).

Longitudinal slope changes

3.2.5.4 In longitudinal profile, for the section with steep slope, a slope change between two consecutive slopes should not exceed 8 per cent.

3.2.5.5 The transition from one slope to another should be accomplished by a curved surface with a rate of change not exceeding … per cent per 30 m (minimum radius of curvature of …. m).

Distance between slope changes

3.2.5.6 Undulations or appreciable changes in slopes located close together along a runway should be avoided. The distance between the points of intersection of two successive curves should not be less than:

a) the sum of the absolute numerical values of the corresponding slope changes multiplied by minimum radius of curvature of …. m; or

b) 45 m;

whichever is greater.

3.2.5.7 Guidance on implementing this specification is given in *Annex 14, Volume I, Attachment A, Section 4.*

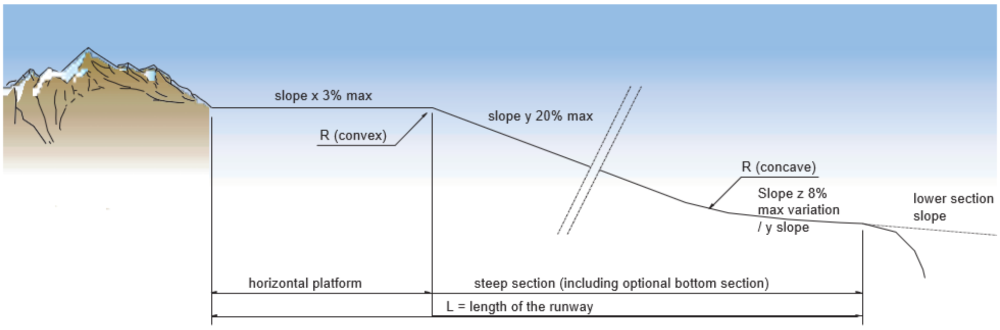

Figure 3 – 2: Schematic longitudinal profile of runway

Transverse slopes of runway

3.2.5.8 To promote the most rapid drainage of water, the runway surface should either be cambered or sloped from high to low in the direction of the wind most frequently associated with rain. A transverse slope should not exceed 2 per cent. For a cambered surface the slope on each side of the centre line should be symmetrical.

3.2.5.9 The transverse slope should be substantially the same throughout the length of the runway except at the intersection with a taxiway where an even transition should be provided taking account of the need for adequate drainage.

3.2.5.10 Guidance on transverse slopes is given in the *Aerodrome Design Manual (Doc 9157), Part 3.*

3.2.3 Strength of runways

3.2.6.1 A runway should have a bearing strength capable of supporting continual traffic of the altiport design aeroplane along the length of the declared take-off run or the declared landing distance, and throughout its full width.

3.2.6.2 A normal landing may impose little or no impact load on the landing surface. However, the load factors arising from an emergency or a badly controlled landing should be considered.

3.2.4 Surface of runways

3.2.7.1 The surface of an altiport runway should be constructed without irregularities that would affect aeroplane performance during take-off or landing. Surface unevenness that would cause vibration or other control difficulties of an aeroplane should be avoided. Guidance on runway surfaces is given in the *Aerodrome Design Manual (9157), Part 3.*

3.2.7.2 Special attention must be paid to the installation of the upper layers, which is difficult due to the existence of a fairly steep slope. The possibility of more rapid erosion due to this slope should also be considered.

3.2.7.3 The texture of the surface of an altiport runway requires special attention in view of the short-field landing requirements. A rough texture surface that is conducive to braking should be used. Where hydroplaning is anticipated to be prevalent, considerations should be given to grooving the runway surface. A grooved surface has been shown to be effective in providing braking action on wet runways. Guidance on methods used to measure surface texture is given in the *Airport Services Manual (9137), Part 2*, while guidance on grooving runways is contained in the *Aerodrome Design Manual (9157), Part 3*.

3.3 Runway strips

3.3.1 General

3.3.1.1 The runway should be included in a runway strip. The purpose of a runway strip is to provide for the following operational considerations:

a) a graded area for aeroplanes accidentally running off the runway;

b) a cleared area for aeroplanes drifting from the runway after take-off;

c) a cleared area for aeroplanes carrying out a missed approach initiated from a very low altitude;

d) an area for the installation of essential visual aids; and

e) an area for drainage and run-off from the runway.

3.3.2 Runway strip width and length

3.3.2.1 Runway strip is an area free of any obstacle containing at least the runway - including its upper section - and its stopway (if provided) in the lower part.

3.3.2.2 To allow the best use of the whole length of the runway, it is recommended, whether the runway is paved or not, to extend the strip beyond the upper end of the runway by a length at least equal to the half of the maximum wingspan of the critical altiport design aeroplane.

3.3.2.3 In the case of a paved runway only, the strip shall extend 30 m beyond the lower end of the runway or its stopway (if provided).

3.3.2.4 An altiport runway strip width of at least 30 m on either side of the centre line is adequate for day-time operations in visual meteorological conditions.

3.3.3 Graded areas

3.3.3.1 To provide for a) in 3.3.1.1, the portion of a runway strip outside the runway and within a distance of ??? m from the centre line of the strip should be graded. The surface of that portion of the runway strip that abuts the runway or stopway edge should be flush with the surface of the paved runway or stopway.

3.3.3.2 To protect a landing aeroplane from the danger of an exposed edge, the runway strip should be prepared against blast erosion to at least 30 m before the start of a runway.

3.3.3.3 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.

3.3.4 Longitudinal and transverse slopes of runway strips

3.3.4.1 The longitudinal slope of the lateral parts of the strip should preferably be identical to that of the runway.

3.3.4.2 When carried out, snow and ice removal must be done on the width of the paved runway. A 0.50 m difference in level at the edge of the runway followed by a 15% upward slope to the lateral limit of the strip may be allowed on both sides.

3.3.4.3 When the runway - whether paved or unpaved - is only groomed, the grooming must be carried out over a minimum width of 30 m, beyond which an upward slope, at a maximum of 15 %, will be extended up to the lateral limit of the strip.

3.3.4.4 The transverse slopes on runway strips should conform to those specified in *Annex 14, Volume I*, for a strip associated with a runway with code number 1.

3.3.5 Objects on runway strips

3.3.5.1 For safety considerations, no object, unless essential as an aid to air navigation, should be installed on a runway strip. Air navigation equipment that must be located on a runway strip should be marked, be of minimum mass and height, and frangibly designed so as to constitute the minimum hazard to aircraft. Frangibility requirements are set out in *Annex 14, Volume I, Chapters 5*.

3.4 Taxiways

3.4.1 General

3.4.1.1 As mentioned in 3.2.1.2, the likely configuration of an altiport is a single runway served by a single taxiway (if provided) or upper transitional platform to link the apron (See Figure 3-1).

3.4.1.2 A taxiway should be designed so that when the cockpit of the design aeroplane is over the taxiway centre line markings, the clearance distance between the outer main wheel of the aeroplane and the edge of the taxiway is not less than 3 m.

3.4.1.3 When designing taxiways at an altiport, the specifications should conform to the Standards and Recommended Practices described in Annex 14, Volume I, Chapter 3. Guidance on design of taxiways is given in the *Aerodrome Design Manual (9157), Part 2*.

3.5 Aprons

3.5.1 General

3.5.1.1 It will be necessary to provide an apron to permit the loading and unloading of passengers and cargo as well as aircraft servicing without interfering with altiport traffic. The distance from the edge of an apron to the edge of a runway strip should be sufficient for an aeroplane parked on the apron not to penetrate the transitional surface.

3.5.1.2 The upper platform of an altiport consists of:

- the upper part of the runway that can be used for landing or take-off maneuvers,
- a holding area where aircraft perform engine tests at the start up point, which can also be used as a turning racket,
- the apron (aircraft parking area).

3.5.1.3 These components can be grassed or paved.

3.5.1.4 Except on the upper portion of the runway, which may be sloped up to 3%, the slope of the upper platform (transitional platform linking to apron) shall not exceed 2% in any direction.

3.5.1.5 Side-by-side parking of aeroplanes and helicopters is not recommended. Since helicopters frequently use the altiports[3], it is recommended to reserve a specific parking area for them.

3.5.1.6 The Figures 3 -1 and Figure 3 – 2 show a schematic diagram of an altiport with a paved runway as well as the longitudinal profile of the runway in its simplest configuration.

3.5.2 Size of aprons

3.5.2.1 The necessary altiport capacity to handle planned or predicted altiport traffic will be the main determinant in establishing an apron's size. An apron's size should be sufficient to contain an adequate number of aircraft parking bays or spaces to cater to the altiport's traffic volume at its highest level.

3.5.2.2 As the number of aircraft parking bays or spaces required will depend, in part, on parking bay occupancy or turnaround time, aircraft operators intending to use the altiport should be consulted with respect to scheduling and other matters that affect the time an aeroplane needs to occupy the apron.

3.5.2.3 The size of an apron will also be governed by the size of the altiport design aeroplane and the parking method selected for use on the apron. While nose-in parking uses less space, economy and convenience will probably dictate self-manoeuvring, angled nose-in or angled nose-out parking. Figure 3-3 depicts a typical altiport apron.

Figure 3 – 3: Example of typical altiport apron

[3] *In this case, the helicopters do not use the steep runway but a final approach and take-off area specifically dedicated to them.*

3.5.3 Strength of aprons

3.5.3.1 An apron should have sufficient bearing strength to support the mass of the altiport design aeroplane, keeping in mind that parts of the apron will be subject to higher stresses owing to slow moving and stationary aeroplanes and other vehicles/equipment.

3.5.4 Slopes of aprons

3.5.4.1. Slopes of an apron should be sufficient to prevent accumulation of water but should not exceed 2 per cent in any direction.

3.5.4.2. Because of the possibility of spilled fuel and the ensuing fire hazard, an apron should not slope down towards a terminal building.

CHAPTER 4. OBSTACLE LIMITATION SURFACES

[Review will be carried out in the next phase to align with OFS and OES]

4.1 General

4.1.1 Obstacle limitation surfaces are established to define the airspace over and around an altiport that must be kept free of obstacles. The limitation surface sets out the limits above which objects should not extend.

4.1.2 In the planning and design of an altiport, obstacle limitation surfaces require careful consideration. In fact, the presence of objects located in the vicinity or planned for construction near an otherwise suitable altiport site may be the overriding factor in whether an altiport will be a realistic project. The operation of an altiport may be significantly affected by features beyond the altiport boundary such as buildings, bridges and towers or mountains, hills etc. Objects that penetrate the obstacle limitation surfaces described in this chapter may, therefore, impose take-off mass limitations, cause an increase in weather minima or both. They may also necessitate the displacement of the threshold.

4.1.3 Once a commitment is made to the establishment of an altiport, the sectors of the local airspace covered by the obstacle limitation surfaces should be regarded as integral to the altiport and therefore inviolable. Consequently, enactment of zoning legislation may be needed to preserve unobstructed airspaces for take-off, approach, missed approach and circling procedures. Legislation aside, the altiport authorities should be involved in community consultation and should maintain close liaison with local development planners to ensure that altiport requirements are included in forecasts and well-integrated into plans.

4.1.4 Altiport obstacle limitation surface requirements are normally set on the assumption that take-offs and landings will be made in a single direction. Therefore, the functions of surfaces may be integrated and the requirements of one surface nullified because of the more stringent requirements of another.

4.1.5 The obstacle limitation surfaces to be defined at an altiport will depend on terrain and the type of operation envisaged at the altiport. At the very minimum, for day time operations in visual meteorological conditions, the surfaces requiring protection are the take-off and approach surface and the transitional surface.

4.1.6 Obstacle limitation surfaces (OLS), specified in Annex 14 Volume I for aerodromes reference code 1 are not suitable for altiports.

4.2 French practices for altiport OLS

4.2.1 The diversity of runway configurations that can be encountered means that obstacle limitation surfaces that can be selected for an altiport can only be chosen after a study of the approach and departure procedures of the aircraft.

4.2.2 The description given below of the obstacle limitation surfaces that can be associated with a unique approach and take-off corridor is therefore only indicative and is only intended to allow dialogue with a flight procedure designers.

Approach and take-off obstacle limitation surfaces

4.2.3 The characteristics in the shape and size, of the obstacle limitation surfaces mean that there is no any difference between approach and take-off obstacle limitation surfaces.

4.2.4 The longitudinal profile of the centreline of the approach and take-off surface as shown in Figure 4 - 1 is generally characterized by:

a) a segment Δ_1 originating on the centre of the width of lower side of the strip and having a negative slope at least as steep as that of the centreline of the lower runway section;

b) a horizontal segment Δ_2; and

c) a segment having positive slope Δ3, the length of which is sufficient for the aircraft on take-off to clear the surrounding obstacles.

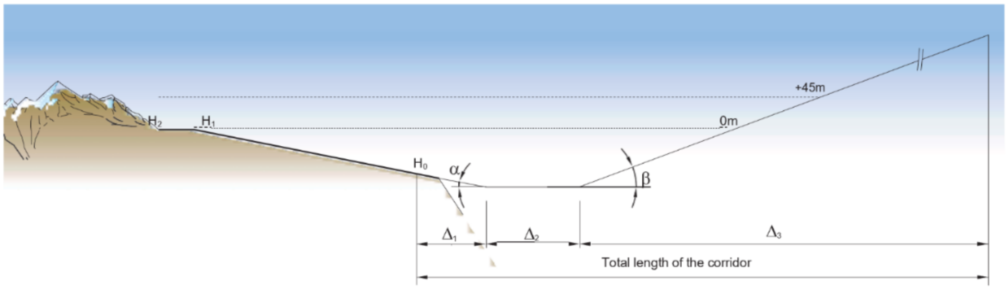

Figure 4 – 1: Longitudinal profile of the approach/take-off surface

4.2.5 Since the total length of the corridor must not be less than 2,000 m, the values of Δ1, Δ2 and Δ3 will be set on a case-by-case basis by the civil aviation services according to:

a) the reference code corresponding to the most critical design aircraft to be served by the altiport; and

b) the operating constraints specific to the site studied.

4.2.6 In a plan view, as shown in Figure 4 – 2, the approach and take-off OLS is connected to the segment perpendicular to the plane containing centreline of the runway passing through the center of the lower width side of the strip (inner edge of the approach surface). Equal at the origin to that of the strip, the width of the approach and take-off OLS grows linearly until it reaches 1 km, with the divergence δ being at least 20%[4]. Beyond that, the width of the corridor plane remains constant and equal to 1 km.

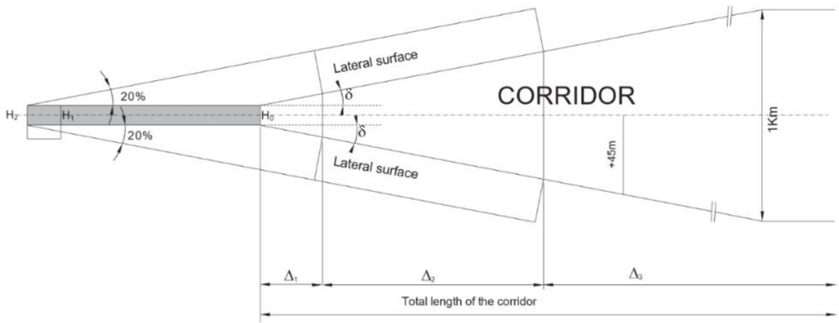

Figure 4 – 2: Plan of altiport approach/take-off surface (corridor) and lateral surface

4 *without having to exceed the value of 30%.*

Lateral obstacle limitation surfaces

4.2.7 The lateral obstacle limitation surfaces consist of two regulated surfaces, forming a plane perpendicular to the centreline of the runway. The lower and upper limits of these lateral OLS, are:

a) on the one hand, the guideline defined by the long sides of the strip and the sides of the trapezoids at the bottom of the approach/take-off corridor corresponding to the first two long profile segments defined above; and

b) on the other hand, the horizontal lines originating from the upper corners of the strip and forming a divergence of 20% with the vertical plane containing the runway centreline.

4.2.8 The selected site must also allow an aircraft to make a low-level pass over the installations before landing in order to ensure that the runway is clear at the top, if necessary.

4.2.9 The conditions of this overfly will also, in each case, be the subject of a particular study to the conclusions of which will be associated the extent of a horizontal obstacle limitation surface. This surface will be placed at a minimum height of 45 m, measured here from the upper platform, and will cover an area included in a circular sector, centred on the upper platform, with a radius equal to 2,000 m and with a sufficient opening[5] to allow the turning of an aircraft of the type admitted on the altiport.

Missed approach surfaces

4.2.10 It is further recommended that a missed approach surfaces be provided to protect the missed approaches.

4.2.11 When the terrain allows this missed approach surfaces to be centred in the extension of the runway (in the case of a mountain pass or dome altiport), it may be constructed as shown in Figure 4-3 below. Its characteristics (lower edge width, slope and divergence) will then be those of the take-off surface of a runway as per *Annex 14, Volume I Chapter 4* for aerodrome reference code 1 (accommodating the same types of aircraft).

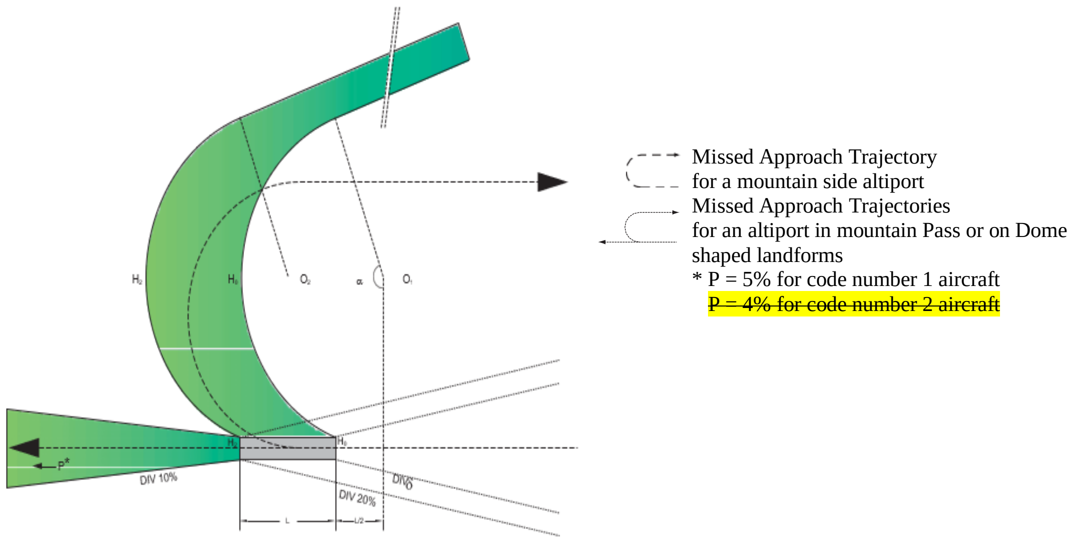

Figure 4 - 3: Missed approach surfaces (Plan)

5 *An opening of 135° seems to be a minimum.*

4.2.12 However, when the terrain does not allow the go-around to continue along the runway (e.g. altiports on the side of a mountain), the approach can only be aborted laterally.

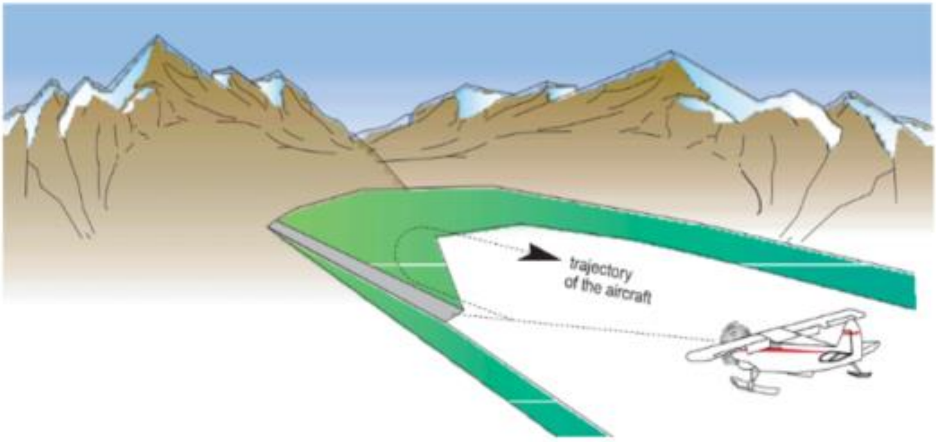

Figure 4 - 3: Missed approach surfaces at altiport on a mountain side

4.2.13 The obstacle limitation surfaces protecting the missed approach will be constructed as shown in Figure 4-3, on the side where the missed approach is to be carried out:

a) the horizontal half-plane having dimension H_o of the lower end of the strip;

b) the regulated surface (cylindrical then flat) whose generators will be contained in a plane parallel to the axial plane of the runway and whose guidelines will be successively;

c) two horizontal arcs of circle of dimensions H_o and H_2 (the latter being that of the small upper side of the strip), each having a radius of at least 600 m, tangent to the axial plane of the runway and whose opening will be equal to the minimum angle of the turn (function of the terrain) to be carried out by the aircraft; and

d) the horizontal tangents at the end of each of these two arcs.

4.2.14 The arc at elevation H_o shall be centred beyond the runway at a distance from its lower end equal to one-half the length of its main steep section.

4.2.15 The arc at H_2 shall be centred at the midpoint of the runway.

4.2.16 Whenever possible, this lateral missed approach surface will complement the missed approach surface along the extended runway centreline where it can be provided, as shown in Figure 4-4.

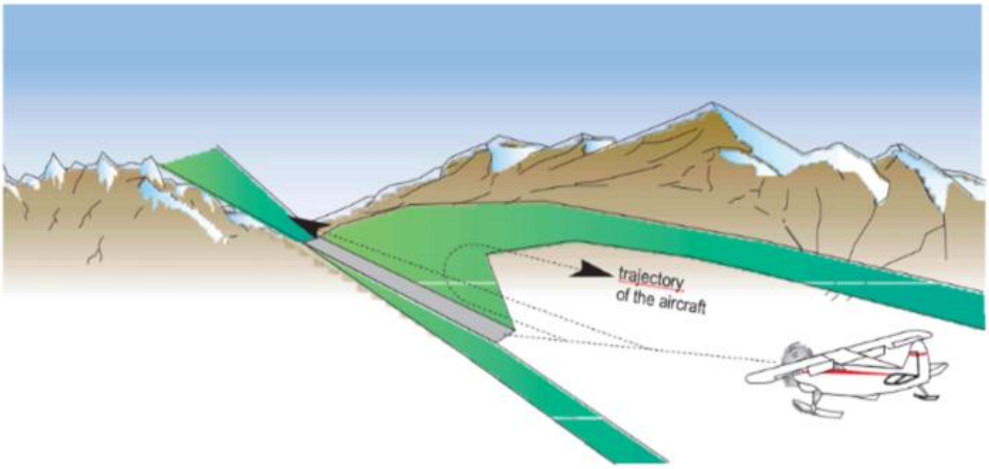

Figure 4 - 3: Missed approach surfaces at altiports in mountain pass or on dome shaped landforms

CHAPTER 5. VISUAL AIDS FOR NAVIGATION

5.1 General

5.1.1 In general, the specifications of Annex 14 Volume I for markings, lights, signs and markers are applicable for altiports.

5.1.2 Center line marking is optional for unpaved runways; however, it may be necessary, at least on the upper part of the runway, to compensate for the lack of visibility caused to the pilot by the change of slope at the beginning of the rolling phase before take-off.

5.1.3 The runway may be equipped with a visual approach slope indicator, such as, PAPI or APAPI.

5.1.4 When an altiport is kept in operation without being cleared of snow, the edges of its runway will be marked with red flags spaced 25 m apart.

5.1.5 Since an altiport can be subject to rapid variations in wind direction and intensity, it is necessary to have a windsock near the holding area for aircraft taking off, and another at the runway threshold for aircraft landing, since the conditions at these two points can be very different.

5.1.6 The visual aids provided at an altiport must serve to provide the pilot with the elements of guidance required to execute safe operations at the altiport.

5.2 Markings

5.2.1 The markings described in this chapter are suitable for altiport operations in visual meteorological conditions. Markings should be conspicuous and provide the maximum possible contrast under various conditions.

5.2.2 Runway markings should be white; taxiway and aircraft stand markings should be yellow and of a consistency that will reduce the risk of uneven braking.

5.3 Runway markings

5.3.1 Runway designation marking

5.3.1.1 A runway designation marking should be provided at the thresholds of a paved and unpaved runway as practicable. It should consist of a two-digit number that is the whole number nearest the one tenth of the magnetic azimuth of the centre line of the runway measured clockwise from magnetic north when viewed from the direction of approach. However, where an altiport is located in an area of compass unreliability a runway designation marking should display true azimuth rather than magnetic azimuth. Runway designation marking shall be in accordance with Annex 14, Volume I, Chapter 5, 5.2.2 as applicable.

5.3.2 Threshold marking

5.3.2.1 A runway threshold should be marked on paved runway with a series of white stripes 15 m long, 1.8 m wide, spaced 1.8 m apart located at the runway end.

5.3.2.2 Where the threshold of an altiport runway is a displaced threshold, the beginning of the altiport runway should be indicated by a transverse stripe at least 1.8 m wide. The portion of the runway before the displaced threshold should be marked with arrows and all other markings should be obliterated.

5.3.2.3 The arrows leading to a displaced threshold should be spaced at intervals of 30 m with the point of the arrow immediately preceding the displaced threshold at 30 m from the transverse stripe.

5.3.2.4 Guidance on the form and dimensions of the arrows are set out in Figure 5-4 A and B of *Annex 14, Volume I*.

5.3.3 Runway centre line marking

5.3.3.1 Runway centre line marking for paved runway shall be in accordance with Annex 14, Volume I, Chapter 5, 5.2.2 as applicable. Runway centre line marking is not required on runways that are 18m wide.

5.3.4 Runway side stripe marking

5.3.4.1 A runway side stripe marking on paved runway should be provided between the thresholds of a paved runway where there is a lack of contrast between the runway edges and the shoulders or the surrounding terrain. A runway side stripe marking should consist of two stripes, one placed along each edge of the runway with the outer edge of each stripe approximately on the edge of the runway. A runway side stripe should have an overall width of at least 0.45m.

5.4 Taxiway marking

5.4.1 The taxiway edge and/or centerline markings should be provided in an altiport. The taxiway markings specified in Annex 14, Volume I, Chapter 5, are considered suitable for altiports.

5.4.2 At an intersection of a taxiway with a runway where the taxiway serves as an exit from the runway, the taxiway centre line marking should be curved into the runway centre line marking. The taxiway centre line marking should consist of a continuous yellow line 15 cm wide parallel to and 1.8 m from the runway centre line marking for 30 m curving at a specified radius to join the taxiway centre line as shown in *Figures 5-6 of Annex 14, Volume I*. The turning radii of the taxiway centerline marking at the intersection of runway and taxiway should be as follows:

a) exits at the ends of a runway - 45 m;

b) 45 degree exits - 90 m;

c) 90 degree exits - 30 m; and

d) 135 degree exits - 30 m.

Figure 5 – 1: Runway marking at Phaplu Airport

5.5 Wind direction indicator

5.4.3 Since an altiport can be subject to rapid variations in wind direction and intensity, it is necessary to have a windsock near the holding area for aircraft taking off, and another at the runway threshold for aircraft landing, since the conditions at these two points can be very different. The specifications for wind direction indicators in *Annex 14, Volume I, Chapter 5*, are considered suitable for altiports.

5.6 Altiport lighting (Optional)

5.6.1 General

5.6.1.1 Altiport lighting should provide effective and safe visual guidance during take-off, approach, landing and ground maneuvering in conditions of minimum visibility.

5.6.1.2 Specifications for the photometric characteristics and setting angles of various elements of altiport lighting will vary according to such factors as altiport environment, ambient light, altiport design aeroplane type and approach path angle. Typical recommended characteristics are shown in Table 5-1.

Table 5-1: Characteristics of altiport light units [Table to be modified]

Light unit	*Type*	*Colour*	*Minimum average intensity cd × 1 000*	*Minimum beam dimension (degrees)*		*Main beam angular setting (degrees)*		*Remarks*
				Horizontal	*Vertical*	*Elevation*	*Angle to C/L*	
High intensity approach lights	Unidirectional	White	20	21	12	12		
Runway identification lights	Unidirectional	White	11	25	25	7.5	20 divergence	60 to 120 CPS
Runway edge	As required	White	10	5	4	4.5	4.5 convergence	
Runway threshold Runway end	Bidirectional	Green — approach; Red — runway;	10	5	4	4.5	4.5 convergence	Factor 0.130 for Red; 0.150 for Green.
Taxiway edge:								
Straight	Bidirectional	Blue	2	3	2	4.5	3 convergence	Factor 0.022 for Blue
Curved	Omni-directional	Blue	2	360	6	3		
Touchdown zone	Floodlight	White	19	60	6			Light beam to be projected on touchdown zone.

5.6.1.3 An altiport designed for use in visual meteorological conditions and intended for use by day should be equipped with the following lighting facilities where change in metrological condition is frequent and the outcome of cost benefit analysis justify in providing lighting facilities:

a) high-intensity runway edge lights;

b) high-intensity runway threshold and runway end lights;

c) runway threshold identification lights (RTIL); and

d) medium-intensity taxiway edge lights.

5.6.2 Light fixtures and supporting structures

5.6.2.1 Elevated approach light fixtures should be mounted on lightweight, frangible supporting structures. Elevated runway, threshold and taxiway lights should be sufficiently low to clear aircraft components and should be frangibly mounted. The *Aerodrome Design Manual (Doc 9157), Part 4*, gives guidance on frangibility of light fixtures and supporting structures.

5.6.3 Light intensity and control

5.6.3.1 Where a high-intensity lighting system is provided, a suitable intensity control should be incorporated to allow for adjustment of the light intensity to meet the prevailing conditions. Separate intensity controls or other suitable methods should be provided to ensure that the following systems, when installed, can be operated at compatible intensities:

a) runway edge lights;

b) runway threshold lights; and

c) runway end lights;

5.6.4 Runway lead-in lights

5.6.4.1 Runway lead-in lights may be provided where other visual aids give insufficient guidance. A runway lead-in lighting system should extend from a point appropriate to the approach path to a point where the runway environment is in view. Each group of lights of a runway lead-in system should consist of at least three flashing white lights in a linear or cluster configuration. The flashing lights in each group should flash in sequence towards the runway. *Aerodrome Design Manual (Doc 9157), Part 4*, gives guidance on providing lead-in lighting systems.

5.6.5 Runway threshold identification lights

5.6.5.1 Runway threshold identification lights should be provided at the threshold of a runway when additional threshold conspicuity is needed or where an approach lighting system is not provided.

5.6.5.2 Runway threshold identification lights should be located in line with the threshold and approximately 10 m outside each line of runway edge lights. They should be flashing white lights with a frequency of between 60 and 120 flashes per minute. The lights should be visible only in the direction of approach to the runway.

5.6.6 Runway edge lights

5.6.6.1 Runway edge lights should be located along the full length of the runway in two parallel, straight lines equidistant from the centre line. The lights should be located 1.5 m from the edge of the runway and the longitudinal distance between lights should be no more than 60 m. The lights on opposite sides of the runway axis should be on lines at right angles to that axis.

5.6.6.2 To alleviate snow removal problems during winter maintenance, the light units may be located up to 3 m from the runway edge and raised. The units, when raised, should be no higher than 35 cm above ground level at 1.5 m from the runway edge and 75 cm above ground level at 3 m from the runway edge. A minimum clearance of 15 cm should be maintained between raised light units and any overhanging part of the critical aeroplane when its main wheels are at the edge of the runway.

5.6.6.3 Runway edge lights should be fixed lights showing variable white except that:

a) where the threshold is displaced, the runway edge lights between the beginning of the runway and the displaced threshold should show red in the approach direction; and

b) the section of runway edge lights one-third of the runway length before the runway end may show yellow.

5.6.6.4 Runway edge lights should show at all angles in azimuth necessary to provide guidance to a pilot landing or taking off. In all these angles of azimuth, runway edge lights should show at angles of elevation above the horizontal appropriate to the approach slope serving the altiport runway.

5.6.7 Runway threshold lights

5.6.7.1 The threshold of an altiport runway should be indicated by six light units, three on each side of the centre line. The lights should be symmetrically located about the runway centre line at right angles to the runway axis and no more than 1.5 m from the extremity of the runway. The outermost lights of the two groups should be located 1.5 m outside the extended line of the runway edge with the remaining lights spaced at 4.5 m from the outermost light.

5.6.7.2 Runway threshold lights should be fixed unidirectional lights showing green in the direction of approach. The light units should have angles of elevation above the horizon appropriate to the approach slope serving the altiport runway.

5.6.8 Threshold wing bar lights

5.6.8.1 Where the altiport runway threshold is a displaced threshold, it should be indicated by two wing bars symmetrically located on each side of the runway edge along the displaced threshold. Each wing bar of displaced runway threshold lights should consist of 3 green lights spaced 4.5 m apart with the innermost light located in line with the runway edge lights.

5.6.9 Runway end lights

5.6.9.1 The end of an altiport runway should be indicated by six light units, three on each side of the centre line. Runway end lights should be symmetrically located about the runway centre line at right angles to the runway axis and no more than 1.5 m from the extremity of the runway. The outermost lights of the two groups should be located 1.5 m outside the extended line of the runway edge with the remaining lights spaced at 4.5 m from the outermost light.

5.6.9.2 Runway end lights should be fixed unidirectional lights showing red in the direction of take-off.

Note.— When the threshold is at the runway extremity, fittings serving as threshold lights may be used as runway end

Figure 5 – 2: Runway Lighting at Tenzing Hillary Airport

5.7 Signs

5.7.1 General

5.7.1.1 Signs may be provided at an altiport to give information or instructions. The guidance on the sizes of signs, their inscriptions, methods of illumination, location, abbreviations commonly used and frangibility of signs given in the *Aerodrome Design Manual (Doc 9157), Part 4*, is applicable to signs at altiports.

5.7.1.2 A sign should be located as near to the edge of the pavement as possible. Signs should be lightweight and frangibly designed and mounted sufficiently low to preserve clearance with any overhanging part of the critical aeroplane.

5.7.1.3 Only mandatory signs on a movement area should use the colour red for background. A sign should be legible from the cockpit of an aircraft at the farthest point of viewing. Where signs are provided for movement areas, they should be lit so as to be legible at poor visibility conditions from a distance of 240 m with the sign's background colour readily discernable.

5.7.2 Mandatory instruction signs

5.7.2.1 When provided, mandatory instruction signs should comprise runway holding position signs and NO ENTRY signs. A NO ENTRY sign should be located at the beginning of an area to which entry is prohibited.

5.7.2.2 Wherever possible, runway holding position signs and NO ENTRY signs should be located on each side of a taxiway facing the direction of approach to the runway or prohibited area. Where for some reason only one sign is utilized it should be located anyside (left or right) wherever feasible.

5.7.2.3 A mandatory instruction sign should consist of a white inscription on a red background and should be illuminated when the altiport is designed for use in poor visibility conditions. Where applicable, the mandatory instruction sign inscriptions set forth in *Annex 14, Volume I, Chapter 5, 5.4.2.12* should be used.

5.7.3 Information signs

5.7.3.1 Given the compressed area and simplicity of a typical altiport, little use of information signs is foreseen. Where required, an information sign should convey information such as a specific location or destination on a movement area. Whenever possible an information sign on a taxiway should be located any side of the taxiway (left or right) wherever feasible.

5.7.3.2 An information sign should consist of either black inscriptions on a yellow background or yellow inscriptions on a black background and should be illuminated when the altiport is designed for use in poor visibility conditions.

5.8 Markers

5.8.1 General

5.8.1.1 Markers should be lightweight and frangibly mounted. Those located near a runway or taxiway should be sufficiently low to preserve clearance with any overhanging part of the critical aeroplane. Guidance on the frangibility of markers is given in the *Aerodrome Design Manual (Doc 9157), Part 4.*

5.8.2 Unpaved runway edge and runway strip markers

5.8.2.1 On unpaved runways, where the runway strip is not maintained to normal grading standards, the runway must be marked using edge markers, except that runway edge markers may be omitted if the full width of the runway strip is maintained suitable for aeroplane operations and the runway strip is marked using strip markers. Where the runway is not provided with edge markers, the threshold locations need to be marked appropriately in the shape of a as shown in Figure 5-3.

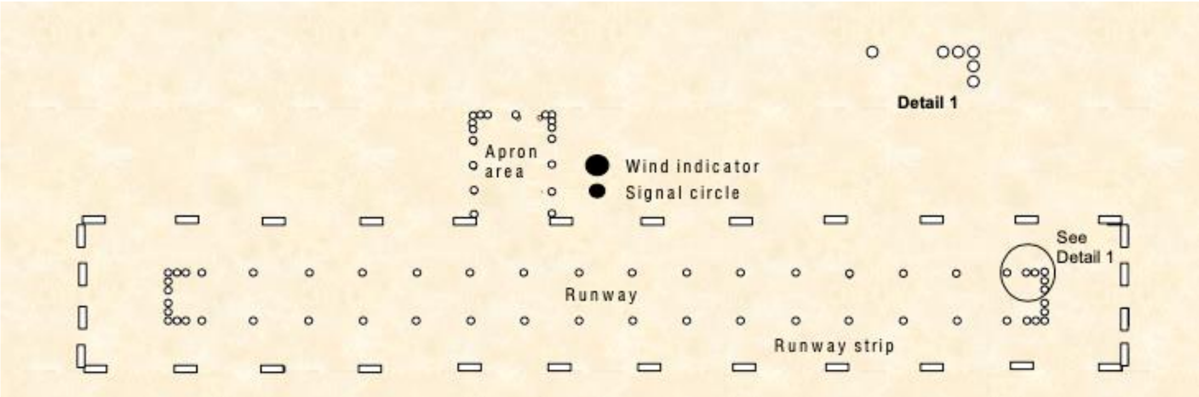

Figure 5 – 3: Runway and runway strip markers

5.8.2.2 If flat rectangular markers are used, they should measure at least 1 m wide by 3 m long, and be placed with the longer dimension parallel to the runway centre line. If conical markers are used, they should not be more than 30 cm high and 0.4 m base diameter.

5.8.2.3 Where runway edge lights are provided, the markers should be part of the light fixtures. Where there are no lights, markers of flat rectangular or conical shape should be located to delineate the runway limits clearly.

5.8.2.4 Runway strip should be marked by using cones, gable markers or tyres. Runway strip cone markers should have a 0.75 m base diameter and be 0.5 m in height. Gable markers should be 3 m in length.

5.8.2.5 Cone or similar size markers need to be spaced not more than 90 m apart. Gable or similar size markers need to be spaced not more than 180 m apart.

5.8.3 Edge markers for snow covered runways

5.8.3.1 When the limits of a snow-covered runway are not otherwise indicated, it is recommended that edge markers should be provided. Edge markers for snow covered runways should be placed along the edges at intervals of not more than 100 m and far enough from the centre line to not interfere with aircraft on the runway. The threshold and end of the runway should be marked.

5.8.3.2 Evergreen trees 1.2 m to 1.5 m high or other conspicuous, lightweight markers are appropriate to be used as edge markers for snow covered runways.

5.8.4 Unpaved taxiway edge markers

5.8.4.1 Taxiway edge markers should be provided where the limits of an unpaved taxiway are not obvious, markers should be provided and taxiway centre line or edge light or taxiway centre line markers are not provided.

5.8.4.2 A taxiway edge marker should be retroreflective blue. The marked surface as viewed by the pilot should be rectangle and should have a minimum viewing are of 150 cm^2.

5.8.4.3 Taxiway edge markers should be frangible. Their height should be sufficiently low to preserve clearance for propellers.

CHAPTER 6. VISUAL AIDS FOR DENOTING OBSTACLES

6.1 Objects to be marked and lighted

6.1.1 The marking and/or lighting of obstacle is intended to reduce hazards to aircraft by indicating the presence of obstacles. It does not necessarily reduce operating limitations which may be imposed by an obstacle.

6.1.2 A fixed obstacle that extends above an approach, or take-off climb surface within 3,000 m (2,000 m as per Fig 4 -1, French practices) of the inner edge should be marked and lighted except that:

a) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle; and

b) the marking may be omitted when the obstacle is lighted by day by high intensity obstacle lights.

6.1.3 A fixed obstacle above an inner horizontal surface should be marked and lighted except that:

a) such marking and lighting may be omitted when:

1) the obstacle is shielded by another fixed obstacle;

2) For an inner horizontal surface extensively obstructed by immovable objects or terrain, circling procedures have been established to ensure safe vertical clearance below the circling flight paths; or

3) the appropriate authority determines that the obstacle has no operational significance through an aeronautical study; and

b) the marking may be omitted when the obstacle is lighted by day by high intensity obstacle lights.

6.1.4 Mobile equipment and vehicles, other than aircraft, on the movement area of an altiport are obstacles and should be marked and lighted except that equipment and vehicles used only on aprons may be exempt.

6.1.5 Elevated aeronautical ground lights within the movement area should be marked so as to be conspicuous by day.

6.2 Marking and lighting of objects

6.2.1 Objects should be marked and lighted in accordance with *Annex 14, Volume 1, Chapter 6, 6.2 or 6.3* as applicable.

CHAPTER 7. VISUAL AIDS FOR DENOTING RESTRICTED USE AREAS

7.1 Closed runway and taxiway marking

7.1.1 Markings denoting a closed runway should be placed at each end of the runway and along the runway at intervals of not more than 300 m.

7.1.2 Markings denoting a closed taxiway should be placed at each end of the taxiway or part of the taxiway that is closed,

7.1.3 Closed runway and taxiway markings should be painted on the surface if permanent but may be made of other materials if the closing is temporary. The marking should be in the form of an "X", each arm of which should be at least 6 m long and 0.9 m wide as shown in Figure 7-1 of *Annex 14, Volume 1*.

7.2 Unserviceable-area marking

7.2.1 Unserviceable portions of a maneuvering area should be conspicuously marked with devices like cones, flags or marker boards placed at intervals that clearly mark the unserviceable area. Characteristics of unserviceable-area marking devices are:

a) a cone should be at least 0.5 m high;

b) a flag should be at least 0.5 m square;

c) a marker board should be at least 0.5 m high and 0.9 m long; and

d) the foregoing devices should be red, orange or yellow or one of these colors in combination with white.

7.3 Pre-threshold area

7.3.1 Where the surface leading to the runway threshold is paved but is not suitable for normal use by aircraft and exceeds 60 m in length, the entire pre-threshold should be marked with yellow chevron markings.

7.3.2 The chevrons should be formed of yellow stripes 0.9 m wide and should be set at an angle of 45 to the extended runway centre line as shown in Figure 7.2 of *Annex 14, Volume I*.

7.4 Non-Loadbearing Surface Marking

7.4.1 Shoulders for taxiways, runway turn pads, aprons and other non-loading bearing surfaces which cannot readily be distinguished from load-bearing surfaces and which, if used by aircraft, might result in damage to the aircraft should have the boundary between such areas and the load-bearing surface marked by a taxi side stripe marking.

7.4.2 A taxi side stripe marking should consist of a pair of solid lines, each 15 cm wide and spaced 15 cm apart and the same colour as the taxiway centre line marking should be placed along the edge of the load-bearing pavement, with the outer edge of the marking approximately on the edge of the load-bearing pavement.

CHAPTER 8. EQUIPMENT AND INSTALLATIONS

8.1 Secondary power supply

8.1.1 Whenever provided, the secondary power should be provided by means of a standby electrical generating unit or by a second, independent public utility source or solar power system. However, where the primary source of electrical power supply is sufficiently safeguarded by duplicate power feeds, a secondary power source or other suitable means, a standby power supply may not be required.

8.1.2 Switch-over from normal power to secondary power should occur automatically within 15 seconds of interruption or deterioration of the normal supply.

8.1.3 A secondary power supply should be provided, capable of supplying the power requirements of at least the altiport facilities listed below:

a) the signalling lamp and the minimum lighting necessary to enable air traffic services personnel to carry out their duties;

b) all obstacle lights which, in the opinion of the Appropriate Authority, are essential to ensure the safe operation of aircraft;

c) runway and taxiway lighting; where provided

d) meteorological equipment; and

e) essential equipment and facilities for the aerodrome responding emergency agencies.

8.1.4 *Annex 14, Volume I*, Chapter 8, provides useful guidance on specifications for secondary power supplies including maximum switch-over times.

8.1.5 Guidance on secondary power supply is given in the *Aerodrome Design Manual (Doc 9157), Part 5*.

8.2 Monitoring

8.2.1 A mechanism of manual monitoring of the visual aids should be employed to ensure the operational status of lighting system at altiport. Guidance on monitoring is given in the *Aerodrome Design Manual (Doc 9157), Part 5.*

CHAPTER 9. ALTIPORT OPERATIONAL SERVICES, EQUIPMENT AND INSTALLATIONS

9.1 Altiport emergency planning

9.1.1 To prepare an altiport to cope with an emergency, altiport planners should use the specifications in *Annex 14, Volume I, Chapter 9*, and the emergency planning guidance contained in the *Airport Services Manual (Doc 9137), Part 7*, to develop an altiport emergency plan commensurate with aircraft operations and other activities.

9.1.2 When established, an altiport emergency plan should provide for the actions to be taken in an emergency occurring at the altiport or in its vicinity. The plan should co-ordinate the response or participation of all agencies that could assist in responding to an emergency. The outline of AEP is given in *Appendix 2 of Airport Service Manual (Doc 9137), Part 7*.

9.1.3 There should be a procedure established for testing an altiport emergency plan with a view to improvement.

9.1.4 If the formal altiport emergency plan cannot be established, the altiport operator should establish an emergency management procedures in accordance with State regulations, which should include the followings:

(a) the positions of those who constitute the membership of the altiport emergency committee (if established);

(b) the description of the role of each emergency service organisation involved in the emergency response arrangements, as applicable;

(c) the procedures for liaison with the authorised person responsible for local emergency planning arrangements;

(d) the procedures for notification and initiation of an emergency response;

(e) the procedures for activation, control and coordination of altiport-based emergency responders (if any) during the initial stages of an emergency;

(f) the procedures for use of the altiport's emergency facilities (if any);

(g) the procedures for facilitating altiport access and the management of assembly areas (if any);

(h) the procedures for an altiport to respond to a "local stand-by" event, if applicable;

(i) the procedures for initial response to a "full emergency" event on, or in the immediate vicinity of, the altiport; and

(j) the arrangements for keeping altiport emergency facilities, access points and assembly areas (if any) in a state of readiness;

(k) arrangements to ensure emergency preparedness by both on and off-altiport responders; and

(l) the arrangements to return the altiport to operational status after an emergency.

9.2 Rescue and fire fighting

9.2.1 An altiport should be provided with appropriate rescue and firefighting equipment and services, the primary objective of which is to save lives in the event of an aircraft accident or fire at the altiport. This objective would be met by making a fire-free escape route for the evacuation or rescue of passengers and crew. A secondary objective is to protect property by containing or extinguishing fire resulting from an aircraft accident.

9.2.2 Rescue and firefighting services should also have a standby function, coming to a high state of readiness when an in-flight emergency is declared. Altiport operators should be guided on rescue and firefighting equipment and services by the specifications in *Annex 14, Volume I, Chapter 9,* and the material in *Annex 14, Volume I, Attachment A, Section 17,* and *the Airport Services Manual (Doc 9137), Part 1*.

9.2.3 When it is not feasible to provide the rescue and firefighting services at an altiport, the altiport operator should establish the following:

a) Installation of fire hydrants and firefighting facilities in appropriate places at an altiport;

b) Ensure the mechanism to deal with rescue operation in normal and difficult terrain during any aircraft incident or accident at or in the vicinity of an altiport;

c) Provision of basic firefighting training to operate the fire hydrants and installed firefighting equipment to the security staff or other available staff at an altiport in an event of fire incident; and

d) MOU with the local security and medical authorities from the vicinity of an altiport for necessary assistance in an event of aircraft incident and accident and structural fire.

9.3 Disabled aircraft removal

9.3.1 An altiport emergency plan should include a plan for removing a disabled aircraft that is on or adjacent to the movement area. Guidance on removal of a disabled aircraft is given in the *Airport Services Manual (Doc 9137), Part 5*.

9.3.2 If an altiport does not have a plan for removal of disabled aircraft, the altiport should have the procedures for removing an aircraft that is disabled on or near the movement area. The procedures may include the following:

a) identifying the roles of the altiport operator and the holder of the aircraft's certificate of registration;

b) notifying the holder of the certificate of registration;

c) obtaining appropriate equipment and persons to remove the aircraft;

d) identifying:

   1) the names and roles of the persons responsible for arranging the removal of an aircraft; and

   2) the telephone numbers for contacting the relevant individuals during and after normal working hours.

9.3.3 The procedures described in 9.3.2 should be in line with national regulations or local government regulations.

Note:- Light aircrafts can also be removed manually without necessitating any specialized equipment.

9.4 Wildlife strike hazard reduction

9.4.1 An altiport operator should institute a method of controlling wildlife (birds and animals) that constitute a hazard to aircraft operations. Guidance on wildlife hazard management is given in the *PANS-Aerodromes (Doc 9981), Part II, Chapters 1 and 6* and *Airport Services Manual (Doc 9137), Part 3*.

9.4.2 An altiport operator should institute a method of controlling wild life hazard for the safe operation of an aircraft.

9.4.3 An altiport should have wildlife hazard management procedures to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the altiport, including details of the arrangements for the following:

a) monitoring wildlife activities at the aerodrome;

b) assessing any wildlife hazard;

c) mitigating any wildlife hazard;

d) reporting wildlife hazards to aircraft through one or more of the following as applicable: the AIP, NOTAM, air traffic control;

e) identifying proposed or actual sources of wildlife attraction outside the altiport boundary; and

f) liaising with the relevant planning authorities or proponents to facilitate wildlife hazard mitigation.

9.5 Apron management service

9.4.1 When warranted by the volume of traffic and operating conditions, an appropriate altiport apron management service should be provided. Procedures on apron safety are specified in the *PANS-Aerodromes (Doc 9981)*. Guidance on an apron management service is given in the *Airport Services Manual, Part 8 (Doc 9137),* and *in the Manual of Surface Movement Guidance and Control Systems (Doc 9476)*.

9.6 Altiport vehicle operation

8.5.1 Guidance on aerodrome vehicle operation is contained in *Annex 14, Volume 1, Attachment A, Section 19* and *PANS-Aerodromes (Doc 9180), Part II, Chapter 9.*

9.7 Siting of equipment and installations on operational areas

9.7.1 Unless its function requires it to be there for air navigation or for aircraft safety purposes, no equipment or installation should be:

a) on a runway strip, a taxiway strip if it would endanger an aircraft; or

b) on a clearway if it would endanger an aircraft in the air.

9.7.2 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on a runway strip and which:

a) penetrates the transitional surface should be of minimum mass and height, frangibly designed and sited to reduce hazards to a minimum. Guidance on the siting of navigation aids is contained in the *Aerodrome Design Manual (Doc 9157), Part 6.*

9.8 Fencing

9.8.1 A fence or other suitable barrier should be provided on an altiport:

a) to prevent the entrance to the movement area of animals large enough to be a hazard to aircraft; and

b) to deter the inadvertent or premeditated access of an unauthorized person onto a non-public area of the altiport.

9.8.2 Suitable means of protection should be provided to deter the inadvertent or premeditated access of unauthorized persons into ground installations and facilities essential for the safety of civil aviation located off the altiport.

9.8.3 A fence or other means should separate the movement area and other facilities or zones on the altiport essential to safe operations from areas open to the public.

9.8.4 Wherever fencing is not feasible to be provided some kind of mechanism should be employed to protect the movement area for the safety of aircraft operations.

CHAPTER 10. ALTIPORT MAINTENANCE

10.1 General

10.1.1 A maintenance programme, including preventive maintenance should be established at an altiport to maintain facilities in a condition that does not impair safety, regularity or efficiency of air navigation.

10.1.2 A maintenance programme developed in accordance with *Annex 14, Volume I, Chapter 10*, and using the following guidance would be suitable for an altiport.

a) Guidance on the maintenance of runway or stopway shoulders is contained in *Annex 14, Volume I, Attachment A, Section 9.1*, and in the *Aerodrome Design Manual (Doc 9157), Part 2.*

b) Guidance on maintenance of a runway surface to preclude harmful irregularities is given in *Annex 14, Volume I, Attachment A, Section 5*.

c) Guidance on runway condition report for reporting runway surface condition is given in *Annex 14, Volume I, Attachment A, Section 6, PANS-Aerodromes (Doc 9981), Part II, Chapter 2 and Circular 355*.

d) Guidance on improving braking action and on the clearing of runways is given in the *Airport Services Manual (Doc 9137), Part 2*.

e) Guidance on suitable chemicals for removing or preventing frost or ice on pavements is given in the *Airport Services Manual (Doc 9137), Part 2*.

10.1.3 A system of preventive maintenance of visual aids should be employed to ensure lighting and marking system reliability. Guidance on preventive maintenance of visual aids is given in the *Airport Services Manual (Doc 9157), Part 9.*

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APPENDIX 1 - ALTIPORT DESIGN AEROPLANES

Notes:- Table 1 contains a list of some aeroplanes in operations at altiports in Indonesia and Nepal. It also contains some aeroplanes whose performance may be suitable for altiport operations. It should be noted that altiport operations may depend not only on an aeroplane's reference field length but also on its ability to achieve certain departure climb and approach angles.

Table 1

S. No	Aeroplanes	Gross Take-off Mass (Kg)	Reference Code	Wing Span (m)	Outer Main Gear Wheel Span (m)	Remarks
A)	**Indonesia**					
1	Cessna - 206					
2	Cessna -208					
3	PC-6					
4	DHC-4 Carribou					
5	DHC-6	5,670	1B			
B)	**Nepal**					
	Cessna – 208 B					
	DHC 6-300 & 400	5,670	1B			
	DO 228-202	6,400				
	L 410 UVP – E20	6,600	1B			
C)	**Others**					
1	PC-12	2,280	2B			Doc 9157, Part 1 – Runways
2	SKYTRADER SCOUT (16 PAX)	4,536				Doc 9150, Stolport Manual

ATTACHMENT A – GUIDANCE MATERIAL SUPPLEMENTARY TO ASIA PACIFIC GUIDANCE ON DESIGN AND OPERATIONS OF ALTIPORTS

1. Runway length

1.1 As for conventional aerodromes, the determination of the length[6] of an altiport runway requires the involvement of an expert service or organization. The simplified method, which is described below, is nevertheless a fairly good approximation for light aeroplanes.

1.2 For the longitudinal profile slopes adopted at altiports, the acceleration of an aeroplane at take-off is only significantly affected, in its rolling phase, compared to what it would be on a substantially horizontal runway, by the effect of the orthogonal projection of the aeroplane's weight on the runway's axis.

1.3 Therefore, if aH denotes the acceleration of the aircraft traveling at speed V on a horizontal runway Figure A1 - 1, the acceleration aα of the same aircraft traveling at the same speed on a slope of an angle α to the horizontal as shown in the Figure A1 - 2 has the value:

$$\mathbf{a}_\alpha = \mathbf{a}_H + g.\ \sin\alpha \ \text{------}\mathbf{A}$$

Figure A1-1

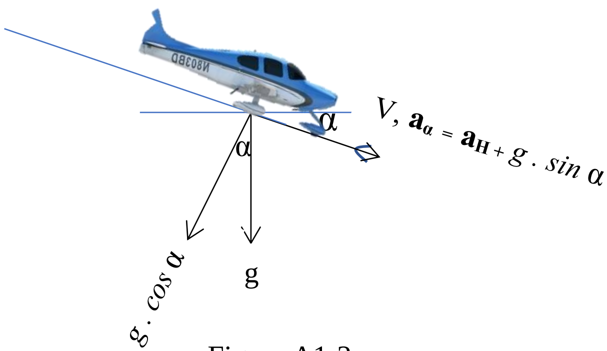

Figure A1-2

1.4 In the case of the deceleration corresponding to an acceleration-stop procedure the force due to gravity would be in opposite direction with respect to deceleration hence the equation-A may be rewrite as:

$$\mathbf{a}_\alpha = \mathbf{a}_H - g\ .\ \sin\alpha\ .\ \text{--------}\ \mathbf{B}$$

1.5 The assumption is made below that an acceleration aH is invariant of the aeroplane type which makes this method as the approximation method.

1.6 Let us take the scenario with the multiple slopes of the runway, where the aeroplane movement uniformly accelerated (respectively decelerated) on each section of runway portion i of constant slope αi and applying the newton's law of motion elimination of the time variable between expressions the distance traveled on the axis and the speed leads to the relation:

6 *In view of the significant slopes, it is specified that the length referred to here is that measured on the ground.*

$2ad = v_f^2 - v_i^2$;

where,

'a' is an acceleration, 'd' is distance travelled and v_f^2 is the final velocity and v_i^2 is the initial velocity of any object/aeroplane.

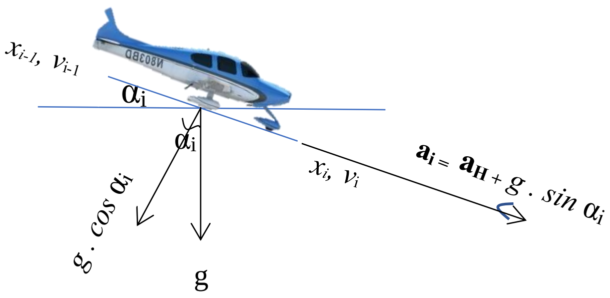

Figure A1-3

$2\,\mathbf{a}_i \cdot (x_i - x_{i-1}) = v_i^2 - v_{i-1}^2$ ---------**C**

in which:

- ✓ $\mathbf{a}_i = \mathbf{a_H} + g.\sin \alpha_i$
- ✓ $(x_i - x_{i-1})$ is the length of the section**,**
- ✓ v_{i-1} is the speed at the origin of said section,
- ✓ v_i is the speed at its end.

Figure A1-4

1.7 By successively writing this relation for each section of constant slope since the release brake (v_0 = 0) until the speed reaches the flight speed $V_{Lof,}$ we obtain a series of equalities, which, by addition, results in the formula giving the length of runway preceding the point where the reference aeroplane leaves the ground after having initiated it's pitch up Figure A1-4.

$2 \sum \mathbf{a}_i \cdot (x_i - x_{i-1}) = V_{Lof}^2$---------**D**

1.8 Note that by making α = 0, in the equation-**D** allows to substitute for the parameter $\mathbf{a}_i$ by value $\mathbf{a_H}$, whose value is not published with respect to the speed V_{Lof} and the distance at the end of at which this speed is reached on a horizontal runway.

1.9 For altiports intended to accommodate exclusively only light aeroplane, to which the method above is intended, the length to be given to the runway is taken equal to the product by 1.25 of the distance thus calculated from the equation-**D**.

1.10 The length of the runway determined under 1.9 should be increased at the rate of 7 per cent per 300 m elevation.

1.11 The length of runway determined under 1.10 should be further increased at the rate of 1 per cent for every 1°C by which the aerodrome reference temperature exceeds the temperature in the standard atmosphere for the aerodrome elevation (see *Table 3-1 of Aerodrome Design Manual (Doc 9157), Part 1 Runways*). If, however, the total correction for elevation and temperature exceeds 35 per cent, the required corrections should be obtained by means of a specific study. The operational characteristics of certain altiport design aeroplanes may indicate that these correction constants for elevation and temperature are not appropriate, and that they may need to be modified by results of aeronautical study based upon conditions existing at the particular site and the operating requirements of such aeroplanes.

1.12 Although current regulations do not require accelerate-stop for light aeroplanes, there is no reason why the possibility of a rejected take-off should not be considered in determining the runway length. Since the above reason applies to the deceleration introduced by the initiation of an accelerate-stop procedure, the decision speed, as may be, as it has been developed, can be determined within its possible range.

1.13 The length of an altiport runway does not necessarily have to provide for operations by the design aeroplane at its maximum mass. Rather, the aeroplane mass selected should be the mass required to carry out its allocated task and different take-off and landing masses may be determined for each site served by the design aeroplane.

2. Runway width

2.1 The width of an altiport runway may be determined by reference to the minimum values previously provided[7] for conventional aerodromes, according to the reference code of the most critical altiport design aeroplane to be accommodated.

2.2 On the basis of this information, if the code letter of an aeroplane does not seem to specify it differently for an altiport than for conventional aerodromes, the fact that the reference field length of the same aeroplane is not in itself significant for an altiport, should not, considering the correlation that exists between this distance and the one necessary for this aeroplane to reach its speed of rotation, be considered as removing all validity to the use of the code number[8] that is associated with it.

2.3 The minimum widths previously provided for conventional aerodromes will therefore be applicable without correction to altiports.

2.4 Thus, the minimum width of the runway will be 50 m in unpaved configuration.

2.5 For paved runways, the absolute minimum width is 18 m.

2.6 The site selection and orientation of a runway in the mountains is generally quite constrained, so particular attention must be paid to crosswinds in determining the width of the runway beyond the minimums thus defined.

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8 *although this situation cannot be established as a rule, it should be noted that, as they use a short take-off and landing runway, the aircraft used at the altiport generally use the code number 1*

ATTACHMENT B

REFERENCES

[To be listed]

1) ICAO Annex 14 Aerodromes, Volume I Aerodrome Design and Operations

2) Aerodrome Design Manual (Doc 9157, Part 1 to 6

3) Airport Planning Manual (Doc 9184), Part 1 – 3

4) Airport Services Manual (Doc 9137), part 1 - 8

5) Stolport Manual (Doc 9150);

6) Instruction Technique sur les Aérodromes Civils (ITAC),DGAC France

7) UNDP/ICAO Project, NEP/82/009, High –altitude STOL Performance Criteria Study, DHC 6 – 300 Series Twin Otter Aircraft, Nepal, February 1988

8) CAAN Flight Operations Requirements Aeroplane, Appendix 9 - STOL Field Clearance Requirements

9) Minimum Safety Requirements for Temporary / Unlicensed Aerodromes, DGCA India;

10) CASA CAAP 92A-1(0): Guidelines on Aerodromes intended for Small Aeroplanes conducting RPT Operations;

11) FAA AC 150/5325-4B: Runway Length Requirements for Airport Design, Chapter 2 Runway Length for Small Airplanes;

12) FAA AC 150/5220-22B: Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns;

13)

AP-ADO/TF TASK LIST
(Updated by AP-ADO/TF/3)

	ACTION ITEM/PLANNED ACTIVITIES	RESPONSIBLE PARTY	TIME FRAME	STATUS	REMARKS
1/1	Identify experts in various AOP fields and maintain a database for the Asia/Pacific Region	States – nomination of experts Secretariat – maintaining database	Continuous	Open	From TOR
1/2	Draft regional guidance for the design and operations of:				From AP-ADO/TF/1 AP-ADO/TF/2 WP/13
	(a) Altiports~~; and~~	Nepal to lead; assisted by China, Fiji, India and Indonesia	December 2021 Final Draft to be submitted by AP-ADO/TF/4	Ongoing	Modified in AP-ADO/TF/2 AP-ADO/TF/3-WP/09 - First draft of the GM
	~~(b) Aerodromes in Constrained Environment~~	~~India to lead; assisted by China, Indonesia, Nepal, United States~~	~~December 2021~~	~~Ongoing~~	~~Modified in AP-ADO/TF/2~~ Task 1/2 (b) deleted by AP-ADO/TF/3
1/3	- Study and discuss aerodrome SARPs and guidance materials related to aerodrome planning, design and operations including PANS-Aerodromes; and - Provide expert advice and clarification to APAC States on any issues related to the implementation of the requirement specified in the SARPs and guidance materials.	States and AP-ADO/TF AP-ADO/TF and Secretariat	Continuous	Ongoing	From TOR 1st sub-item: – AP-ADO/TF/2 WP/05, WP/06, IP/02, IP/03 & IP/04 – AP-ADO/TF/3-IP/04

	ACTION ITEM/PLANNED ACTIVITIES	RESPONSIBLE PARTY	TIME FRAME	STATUS	REMARKS
1/4	- Review and discuss AOP parts of the Asia/Pacific ANP and Seamless ANS Plan; and - Formulate amendment proposals to the APAC ANP Table AOP I - 1 and Table AOP II – 1 as necessary.	~~States and Secretariat~~ AP-ADO/TF States and Secretariat	Continuous	Ongoing	From TOR 1st sub-item: – AP-ADO/TF/2 WP/03 & WP/08 – AP-ADO/TF/3-WP/08
2/1	Conduct seminars / workshops for aerodrome regulatory and aerodrome operator staff in APAC Region	~~China – GRF Implementation~~ ~~India – GRF Implementation~~ ~~Thailand (Airports of Thailand) - GRF Implementation~~ ~~United States – GRF Implementation~~	~~Q3-Q4 2021~~ ~~Q3-Q4 2021~~ ~~Q3-Q4 2021~~ ~~Q4 2021 - Q1 2022~~	~~Open~~	~~The seminars/ workshops for GRF implementation will involve all stakeholders e.g. CAA, airports, airlines, ANSP, etc.~~ ~~Winter operations are covered by China and United States~~ China, India & Thailand implemented GRF on 4 Nov. 2021. Conducted GRF Webinars in 2021 in coordination with: – FTF, ACI, IFALPA, IFATCA and IFAIMA – Japan incorporating winter operations
3/1	Technical assistance/Workshop for APAC States that have yet to implement GRF	United States FAA (upon request and on case by case basis)	2022		
3/2	GRF Seminar	China (Lead), ACI & ICAO	Q3, 2022		