NATIONAL TRANSPORT RESEARCH CENTRE

GOVERNMENT OF PAKISTAN

MINISTRY OF COMMUNICATIONS

PLANNING STANDARDS FOR AIRPORTS IN PAKISTAN

NTRC - 176

NATIONAL TRANSPORT RESEARCH CENTRE
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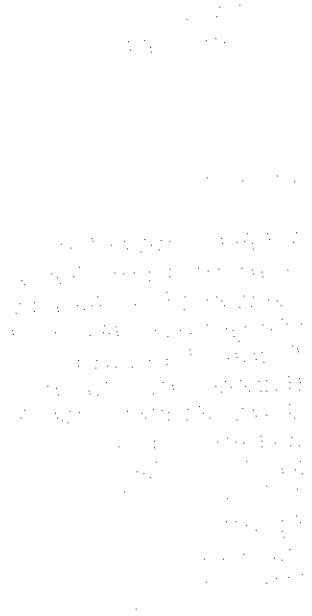

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EXECUTIVE SUMMARY

Planning Standards are a pre-requisite for proper development of airport. Such standards are required to ensure maximum aircraft and passengers safety, convenience to passengers, environmental protection and overall efficiency and economy. For the standards to be able to help achieve the requisite objectives, it is essential that these be based on scientific principles, incorporating the latest state of the art and be clearly understood and endorsed by all concerned. Unfortunately, no standards have been developed in the country which could serve as a yardstick for construction of the new and further expansion of the existing airports.

With the advent of increased high speed traffic of wide bodied aircrafts, higher operating costs and other restrictions, there is a need for establishing uniform policies and procedures in the country for Planning of the airports in the most economical manner.

The study aims at preparing planning standards for airports and their allied facilities in Pakistan, keeping in view the local conditions, environment and other socio-economic consideration. The draft report is prepared by the Centre on the basis of information extracted from various Design manuals and Advisory circulars published by Federal Aviation Administration of U.S.A. (FAA) and International Civil Aviation Organization (ICAO). The important parameters discussed in the report are Runways, Taxiways, Aprons, Airfield Lighting and Marking, Electronic, Visual and Radio Navigational Aids.

The standards recommended by NTRC are proposed to be scrutinized by a Committee consisting of planning and design experts from CAA, PIA, Ministry of Defence and the Planning Commission to evaluate which standards may be the most appropriate to be used for Pakistan.

CHAPTER - I

INTRODUCTION

Planning Standards for the airports are a pre-requisite for the well planned development of airport and their allied facilities. Different guidelines/criteria have been provided by various international agencies like ICAO and FAA for planning and design of various components of an airport.

In Pakistan unfortunately we do not have any fixed standards and procedures for planning and designing of airports and as such our consultants, designers depend upon standards of other international agencies which may cater for their local conditions and environments.

The existing airports in Pakistan have not been developed on the basis of fixed standards as regards design of runways, taxiways, aprons, navigational aids, airfield lightings and markings. Henceforth there is need to develop guidelines which could be appropriate to meet the local conditions and requirements.

Methodology:

A) Aerodrome Dimensions and related information
Data for the following was obtained from ICAO annexures and FAA Advisory Circulars.

1) Length, Width, Slopes of Runways, Shoulders, Strip and Runway End Safety Areas, Runway Blast Pads, Areas to be graded, Sight distance.

2) Widths, slopes, Areas to be graded for Taxiways, Taxiway Strip or Safety Area and Taxiway separation distances.

3) Size and slope of Aprons.

4) Location and characteristics for emergency access roads.

5) Airfield Lighting requirements for Runway, Taxiway, Apron, Precision Approach Category-II, Lighting and Obstruction lights.

6) Requirements for Electronic and Visual Navigational Aids.

7) Requirements for Signing and Marking of Runways, Taxiways, threshold, Aprons.

B) Airport Classification:

For the purpose of stipulating geometric design standards for the various sizes of airports and the functions which they serve, letter and numerical codes or word descriptors have been adopted in this study to classify airports,

1) ICAO Aerodrome Reference Codes

The ICAO uses a two element reference code to classify the geometric design standards for airports. The code element consists of a numeric and alphabetic designation. The code numbers 1 through 4 classify the length of the runway available and the code letters A though E classify the wingspan and outer main gear wheel span for the aircraft for which the airport has been designed. The aerodrome reference codes are given in Table-1.

Aerodrome reference code. Table-1

Code element 1			Code element 2	
Code number (1)	Aeroplane reference field length (2)	Code letter (3)	Wing span (4)	Outer main gear wheel span (5)
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1 200 m	B	15 m up to but not including 24 m.	4.5 m up to but including 6 m.
3	1 200 m up to but not including 1 800 m.	C	24 m up to but not including 36 m.	6 m up to but not including 9 m.
4.	1 800 m and over	D	36 m up to but not including 52 m.	9 m up to but not including 14 m.
		E	52 m up to but not including 65 m.	9 m up to but not including 14 m.

a. Distance between the outside edges of the main gear wheels.

Source: "Annexure 14 to the Convention of Internation Civil Aviation" Eighth Edition,

2) FAA-Airport Classification System

The FAA classification of airports is based upon the approach category of aircraft. The approach category, as shown in Table-2 is determined by the aircraft approach speed, which is defined as 1.3 times the stall speed in

the landing configuration of that aircraft at maximum gross landing weight. Aircraft with maximum certified take-off weights in excess of 12,500 lb are classified as large aircraft; the rest are small aircraft.

Table-2

FAA Aircraft
Approach Category Classification

Approach Category	Approach speed, kn
A	Less than 91
B	91-120
C	121-140
D	141-165
E	166 or greater

Source: Federal Aviation Administraion.

The airplane design groups are defined according to the wingspan of the most demanding aircraft using the airport. These are shown in Table-3. The wingspan ranges specified by the ICAO letter codes are similar to those specified by the FAA airplane design groups.

Table-3

FAA Airplane Design Group
Classification for Geometric Design for Airports

Airplane design group	Wingspan, (Meters)	Typical aircraft
I	Less than 15	Learjet 24, Rockwell Sabre 75A
II	15 but less than 24	Gulfstream II, Rockwell Sabre 80
III	24 but less than 36	B-727,B737,BAC-II,B-757,B-767, Concorde, L-1011, DC-9,
IV	36 but less than 52	A-300,A-310, B-707, DC-8
V	52 but less than 60	B-747
VI	60 but less than 80	Future

Source: Federal Aviation Administration

OBJECTIVES OF ICAO AND FAA

1. International Civil Aviation Organization

The most important international agency concerned with airport development is the ICAO, which is now a specialized agency of the United Nations with headquarters in Montreal, Canada.

The ICAO was formed in Chicago in 1944. The objectives of ICAO as stated in its charter are to dvelop the principles and techniques of international air transportation so as to :

1. Ensure the safe and orderly growth of international civil aviation throughout the world.
2. Encourage the development of airways, airports, and air-navigation facilities for international aviation.
3. Meet the needs of the peoples of the world for safe, regular, efficient, and economical air transport.
4. Ensure that the rights of contracting states are fully respected and that every contracting state has a fair opportunity to operate international airlines.
5. Promote safety of flight in internationl air navigation.

2. Federal Aviation Administration of USA.

The FAA performs the following functions:

1. Encourages the establishment of civil airways, landing areas, and other air facilities.
2. Designates federal airways; acquires, establishes, operates, and conducts research and deevelopment; and maintains air navigation facilities along such civil airways.
3. Undertakes or supervises technical development work in the field of aeronautics and the development of aeronautical facilities.
4. Provides consultation and advisory assistance on airport planning design, construction, management, operation, and maintenance to governmental professional, industrial, and other individuals and agencies.
5. Develops and establishes standards, government planning methods, and procedures; airport and seaplane base design and construction; and airport management, operation, and maintenance.

CHAPTER-II

PHYSICAL CHARACTERISTICS

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
1. RUNWAYS:			
1.1 Runway Basic Length (Approximate Runway Length for FAA)		Transport Airports	
	2100 and over for code letter A	2100 - 3600m for Airplane Design Group III-IV	ICAO Requirements
	1500m upto but not including 2100m for code letter B	1500 for Airplance Design Group I & II	
	900m upto but not including 1500m for code letter C.	1000m for General Utility Stage II Airports	
		915m for General Utility Stage-I Airports	
	750m upto but not including 900m for code letter D.	760m for Basic Utility Stage II Airports	
	600m upto but not including 750m for code letter E.	610m for General Utility Stage I Airports	

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
1.5 Transverse-slope	1.5% max. downward for runway code letter E	1% to 1.5% downward	1.5% downward
2. RUNWAY - SHOULDERS			
2.1 Paved-Width	Overall width of the runway and its shoulders not less than 60 m.	10.5m.min. for Aircraft Design Gr.V	7.5m. (overall) width of runway and shoulders = 45+(2x7.5) = 60m.
2.2 Tranverse Slope	2.5% max. downward	1.5% to 5% downward	2% downward
3. RUNWAY-STRIP AND RUNWAY END SAFETY AREAS (SAFETY AREA AS PER FAA)			
3.1 Length	Runway strip should extend before threshold and beyond the end of runway or stop ways for a distance of at least 60m for code No.4 Runway strip (Length of ruwnway +stopway + 60m. at eachend) + runway and safety areas (distance from end of runway Strip upto ILS localizer)	Runway Safety Area Length=300m beyond each runway end.	ICAO requirements

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Slope changes before runways.	Slope changes to be avoided or kept to a minimum on an area symmetrical about the extended runway centerline approximately 60m wide and 300m. long before the threshold of a precision approach runway. Where slope changes cannot be avoided, the rate of change between two consecutive slope should not exceed 2% per 30m.	0 to 3% upward on downward	ICAO requirements
Rate of change of vertical curve	0.1% per 30m. max. for runway code number 4	0.1% per 30m. max.	0.1% per 30m. upto 1.5% slope change
Min. Distance between slope changes	30,000m x sum of grade changes in decimals or 45m. whichever is greater for code	300m. x sum of grade changes in percent	ICAO requirements 45m
Sight distance	Any two points 3m. above runway surface shall be mutually visible for half the length of runway for Code letter C,D or E	No specific line-of-sight required for airports having 24-hour control tower	ICAO requirements.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
		ii) Aircraft's maximum landing weight plus the weight of the fuel required to fly to the airport of destination.	- Fuel for 45 minute holding. d) For landing distance requirement, the maximum landing weight of the critical aircraft is used.
1.3 Width	45m. min for runway code letter E and code number 4	45 m.min. for Aircraft Design Gr.V	45m.
1.4 Longitudinal Slopes			
Effective Gradient.	1% max. upward or downward for runway code number 4	Not specified	1% max. upward or downward
On any portion of runway.	1.25% max. upward or downward for runway code number 4	1.5% max. upward or downward	0.5% max. upward or downward.
On first and last quarters of runway.	0.8% max.upward or downward for runway code number 4	0.8% max. upward or downward	1.25% max. upward or downward
Slope changes on Runways.	1.5% max. for runway code number 4	1.5% max.	1.5% max.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
1.2 Actual Length of Runways.	Primary Runways: Actual length should adequate to meet the operational requirements of aeroplanes for which the runway is intended and should not be less than the longer length determined by applying the correction for local condition to the operations and performance characteristics of the relevant aeroplanes. ii) Secondary Runways: The length should be adequate for those aeroplanes which require to use that secondary runway in addition to the other runway or runways for usability factor of atleast 95 percent.	- Selected airplane which the runway is to accomodate. - The longest non stop distance expected to be flown from the airport atleast 250 times a year by the selected airplane - Airport elevation above mean sea level. - Main daily maximum temperature for the hotest month. - Take off Weight: i) Aircraft's zero fuel weight plus the weight of the fuel required to fly to the airport of destination plus weight of fuel reserves required for 1 hour and 15 minutes of flying time.	The requird runway is taken as the balanced field length for: a) Airport elevation b) Reference Temperature c) Take-off weight, the sum of: - Operating Weight empty - Full passenger complement at 92.5kg per passenger including baggage for scheduled flights, 100 kg per passenger for Haj flights. - Trip fuel for the longest direct flight along airways. - Reserve fuel for the designated alternate.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
3.2 Width	300m. for runway strip, or twice the width of runway or wider for runway end safety areas throughout the length of the strip	150m.	300m. for runway strip. 150m. for runway end safety areas.
3.3 Areas to be graded	Grading to a distance of 105m. from runway centreline except that the distance is reduced to 75m. at both ends of runway strip. The entire runway end safety areas should be graded.	Grading on the entire safety area. However subsurface drainage, covered culverts, underground structures, frangibly mounted air navigational aids which because of their function require location in runway safety area, may be permitted.	Grading to a distance of 105m. from runway centreline for the whole length of runway strip, and on the whole runway end safety areas.
3.4 Longitudinal slope Slope beyond runway end.	On runway strip 1.5% max On runway end safety areas: No part of the areas penetrates the approach or takeoff climb surfaces. 5% max. downward slope	On the first 60m 0% to 3% downward. On the remainder of the area: No part of the area penetrates the approach or clearway plane, 5% max. downward	On runway strip, 0% to 1.5% max. downward(no upward slope allowed) On runway end safety areas: ICAO and FAA requirements.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Slope change beyond runway area.	Should be avoided or kept to a minimum. If not avoidable, 2% per 30m. is max. Abrupt changes or sudden reversals of slopes should be avoided	+ 2% per 30m. parabolic vertical curves should be used	ICAO requirements
3.5 Transverse Slopes	On runway strip: 5% downward for the first 3m outward from edge of shoulder. 2.5% max. downward beyond 3m. from edge of shoulder. 5% max. updward beyond graded area as measured in direction away from runway. On runway end safety areas: 5% max. upward or downward. Transitions between different slopes should be as gradual as practicable.	On runway with 60m. each end: 5% max downward for the first 3m outward from edge of shoulder. 1.5% to 3% max. downward beyond 3m. from edge of shoulder Beyond 60m. from runway end: 5% max. upward or downward	On runway strip: 5% downward for the first 3m outward from edge of shoulder except at runway/taxiway intersection. 1.5% to 2.5% downward beyond 3m. from edge of shoulder except for areas traversed by taxiway strips On runway end safety areas: ICAO requirements.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
5. TAXIWAYS.			
5.1 Width			
Width on tangent.	23m. min. for runway code letter E	23m. min: for Aircraft Design Gr.V.	23m.
Width on turn	4.5m. min: for clearance distance between aircraft outer main wheels and edge of taxiway	4.5m. min. for taxiway edge safety margin	(4.5 min)ICAO & FAA requirements. Potential obstacles at taxiway turns to be set back to allow sufficient clearance for future aircraft.
Length of venture	Not specified	Length of lead-in to fillet =75m.	75m. To be vertical to meet ICAO requirements for taxiway width on turns.
5.2 Taxiway Speed & Radius of Curvature			

Speed km/hr	Rad of Curve (m)
32	60
48	135
64	240
26	540

Speed km/hr	Rad of Curve (m)
30	54
40	96
50	150
90	486

ICAO Requirements

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
5.3 Longitudinal Slope			
Maximum Slope	1.5% max. upward or downward	1.5% max. upward or downward	1.5% max. upward or downward
Rate of change of vertical curve	1% Per 30m. max. (min. radius of curvature: 3000m)	1% per 30m. max. (radius of curvature 3000m)	1% per 30m.max. 3% maximum slope change.
Distance between slope change	Not specified	3% max. slope change Min. 30m. x sum of slope changes in percent	FAA requirements
Sight distance	From any point 3m above the taxiway, it shall be possible to see the whole surface of taxiway for a distance of 300m from that point.	Not specified	ICAO requirements
Elevation differential to parallel runway taxiway and aprons	Not specified	At future stub taxiway locations, the elevation differential between taxiway centerline to associated parallel runway, taxiways or apron edges should not exceed 1.5% upward or downward of the shortest distance.	FAA requirements

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
5.4 Transverse slope	1.5% max. downward	1% to 1.5% downward	1.5% min downward
6. TAXIWAY SHOULDER			
6.1 Paved-Width	Overall width of the taxiway and its shoulders not less than 44m. (10.5m width on both sides of Taxiways	10.5m for Aircraft Design Gr.V.	11m. for all runway systems
6.2 Transverse Slope	1.5%	1.5% to 5% downward	2% downdward
7. TAXIWAY STRIP OR SAFETY AREA			
7.1 Width of Graded Area	44m. min	60m. min for Aircraft Design group V,80m. min for Aircraft Design group VI.	44m.
7.2 Longitudinal Slope			
Max. Slope	Not specified	1.5% max. upward or downward	2.5% max. upward or downward.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Slope change, vertical curve and distance between slope change.	Not specified	Same as taxiways	FAA requirements
7.3 Transverse Slope			
First 3m. outward from edge of shoulder	Not specified	5% downward	5% downward
Beyond 3m. from edge of shoulder	2.5% max. upward with reference to the transverse slope of the adjacent taxiway. 5% max. downward measured with reference to the horizontal.	1.5% to 3% downward	1.5% to 3% downward
7.4 Taxiway Separation Distances (m)			
Taxiway centre line and runway centre line	182.5m. for Code No.4 and Code Letter.E	150m for Air Plane Design Group V	FAA Requirements
Taxiway centre line and Taxiway centre line	80m	76.5m For Airplane Design Group V	ICAO Reqirements

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
8. APRONS			
8.1 Size	The apron area should be adequate to permit expeditious handling of the aerodrome traffic at its maximum anticipated density.	The size of aprons depend on volume of activity, size and configuration of aircraft, taxing procedures, jet blast, and clearances.	ICAO and FAA requirements
8.2 Slope	1% max.	1% max. 0.5% in fueling areas	1% max.
9. EMERGENCY ACCESS ROADS			
9.1 Location	Located so as to provide ready access to approach area up to 1000m from the threshold without violation of the obstacle limitation surfaces by any vehicle	Located so that the entire safety area is accessible	ICAO requirements.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
9.2 Characteristics	Capable of supporting heaviest vehicles which shall use them in all weather conditions, surfaced within 90m. of a runway.	Capable of supporting fire-fighting and rescue equipment ment travelling at normal response speeds in all weather conditions. Wide enough for use of fire-fighting and rescue equipment available at the airport. The first 90m. adjacent to a paved operational surface should be paved.	FAA requirements
10. AREAS TO BE PROTECTED AGAINST BLAST EROSION	Not specified	Protection of soils in the areas adjacent to runways and taxiways is required	Areas adjacent to blast pads and shoulders and susceptible to blast erosion shall be protected by surface treatment The limits of the protected areas shall be determined in the design.

CHAPTER-III

AIRFIELD LIGHTINGS

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
11. RUNWAY LIGHTING			
11.1 Edge Lights	Required for precision approach runway (all categories)	Required for instrument runways	Required Lights shall be elevated except for those located in inter sections with taxiways, where semiflush type shall be used instead.
- Distance from Runway Edge	3.00m Max.	3.00m.max.	3.00m.max.
- Longitudinal spacing	60.00m.max for Instruments Runway	61.00m.max	60.00m.max
- Runway Section with yellow lights.	600.00m from runway end to runway end	600.00m from runway end to runway end.	600.00m from runway end to runway end.
11.2 Threshold Lights	Required for all runways equipped with edge lights.	Required for all runways equipped with edge lights	Required
- Distance from Threshold.	3.00m. max	0.6m. min. 3.00m. max	3.00m.
- Light Arrangement	Uniformly spaced between lines of edge lights for runway Cat II or III	Uniformly spaced between lines of edge lights for precision approach runways.	Uniformly spaced between lines of edge lights.
- Lateral spacing	3.00m.max	1.50m. for precision approach	1.50m.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
11.3 Wing Bar Lights	Desirable on precision approach runways.	Required, in conjunction with approach lighting Systems	Required
- Distance extended outward and at angle 1 to line of edge lights.	10.00m. min	10.50 m.	10.50 m.
- Number of Lights	Five light min.	Seven lights	Seven lights
Lateral spacing in bar	Not specified	1.50 m.	1.50 m.
11.4 End Light	Required for all runways equipped with edge lights	Required for Instrument runways	Required
- Distance from Threshold.	3.00 m. max	0.60 m. min, 3.00m. max.	3.00 m.
- Light Arrangement	Equally spaced or arranged in two groups between lines of edge lights	Arranged in two groups with four lights min. in each group.	Equally spaced between lines of edge lights. Will be combined with threshold lights.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Lateral spacing	6.00 m. max for precision approach runway Cat.III.	3.00 m. min	3.00 m.
- No. of lights	6 lights min.	8 lights min	23 lights
11.5 Centerline lights	Required for all precision approach runways Cat.II or III.	Required for all precision approach runways Cat II and III.	Required
- Longitudinal spacing	7.50 m. or 15.00 m. on precision approach runways Cat.III.	15.00 m.	15.00 m.
	7.50 m. 15.00 m. or 30.00 m. on precision approach runway Cat.II.		
- Allowable offset from runway centerline.	0.60 m.max. where it is not practicable to locate them along the centerline.	0.60 m. max to either the right or left side of Runway marking	ICAO requirments

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Runway section with white lights.	From threshold to 900m. from runway end.	From threshold to 900 m. from runway end.	From thrshold to 900 m. from runway end.
- Runway section with alternate red and white lights.	900 m. to 300 m. from runway end.	900 m. to 300 m. from runway end.	900 m. to 300 m. from runway end.
- Runway section with red lights.	300 m. from runway end to runway end.	300 m. from runway end to runway end.	300 m. from runway end to runway end.
11.6 Touch Down-Zone Lights	Required for all precision approach runways Cat.II or III	Required for Cat-II & III Runways.	Required
- Longitudianl distance extended over from threshold.	900 m.	900 m.	900 m.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Lateral spacing between innermost lights of barrettes	Equal to the lateral spacing selected for touchdown zone marking.	21.60 m. max. 19.50 m. min.	ICAO requirements.
- Number of lights in each barrette.	Three lights min.	Three lights.	Three lights
- Longitudinal spacing between barrettes.	30.00 m. for lower visibility min.	30.00 m.	30.00 m.
- Distance of first barrette from runway threshold.	Not specified	30.00 m.	30.00 m.
- Length of barrettes	3.00 m. min, 4.50 m. max.	3.00 m.	3.00 m.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
12. TAXIWAY LIGHTING			
12.1 Centerline lights	Required for all taxiways and aprons intended for use when runway visual range (RVR) less than 400 m.	Required for all taxiways used under limited visibility conditions.	Required
- Longitudinal spacing on straight sections.	15.00 m. max. for RVR less than 400 m.	15.00 m. max. for RVR less than 400 m.	15.00 m.
- Longitudinal spacing on Curves for RVR = 400m or greater			
- Radius upto 400m	7.50 m. max.	3.75 m. 7.50 m. 15.00 m	3.75 m. 7.50 m. 7.50 m.
- Radius 401 m and greater	15.00 m.	15.00 m.	15.00 m.
- Longitudinal spacing before or after curve	Light spacing on curve should extend for 60m max. before and after the curve.	Not specified	ICAO requirements.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
12.2 Edge Lights	Required on taxiway not provided with centerline lights. Desirable where there may be a need to delineate the edges of a taxiway.	Required on taxiway not provided with centerline lights	Required on all taxiway intersections. Lights shall be elevated and shielded where necessary.
- Distance from taxiway edge.	3m. max.	3 m. max.	3 m.
- Longitudianl spacing			
- On straight section	60m max.	61.00 m. max.	Variable, 60 m. max.
- On Curve	Less than 60 m, to indicate clearly the curve.	Less then 60 m. varies with radius of the curve	FAA requirements.
12.3 Stop Bars	Required at taxi-holding position used in conjunction with a precision approach runway Cat.III	Not specified	Required at holding position on entrance taxiways to runways.

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Number of lights and lateral spacing	Every 3.00 m. across the taxiway width	-	Every 3.00 m. across the taxiway width.
- Characteristics.	Showing red in direction of approach to intersection or Taxi Holding position.		ICAO pattern
12.4 Clearance Bars	Required at taxiway intersection where it is desirable to define a specific airoplane holding limit	Recommended (hold bars)	Provided at holding positions on taxiway having no stop bars.
- Location	30.00 m. to 60.00 m. from near edge of intersection taxiway.	To meet specific operation requirement.	ICAO requirements.
- Number of lights in bar	Three lights min.	Three lights	Three lights.
- Lateral spacing	1.50 m.	1.50 m.	1.50 m.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
12.5 Taxiholding Position Lights			
	Required at taxiholding position used in conjunction. with a precision approach' runway Cat.III	Not specified	ICAO requirements
- Location			
	One yellow flashing light located at each side of a taxiholding position, as close as possible to the taxiway edge.	Not specified	ICAO requirements
13. APRON LIGHTING			
13.1 Edge Lights			
	Required	Required	Required
- Distance from apron edge			
	3m. max.	3m. max.	3m.
- Longitudinal spacing			
	Same as taxiway edge lights	Same as taxiway edge lights.	Same as taxiway edge lightsd

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
13.2 Taxiline Centerline Lights	Required	Required	Required
- Longitudinal spacing	Same as taxiway centreline lights.	Same as taxiway centreline lights.	Same as taxiway centreline lights.
13.3 Flood Lights	Required	Not specified	Required for passenger terminal, VVIP terminal and air cargo.
14. PRECISION APPROACH CATEGORY II LIGHTING SYSTEMS.	Required for Cat.II ALS.	Required, ALSF-2	Required
14.1 Centerline lights			
- Longitudinal distance extended over from runway threshold.	900.00 m.	720.00 m. if glide slope angle is more than 2.75 deg; 900.00 m. if glide slope angle is less than 2.75 deg. (+ 15 m. tolerance)	900.00 m. (tolerance + 15 m. max.)

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Position of innermost barrette.	30.00 m. from runway threshold.	30.00 m. from threshold light bar	30.00 from hold light bar.
- Longitudinal spacing	30.00 m.	30.00 m.	30.00 m.
- Length of barrettes.	4.00 m. min.	4.00 m.	4.00 m.
- Lateral spacing between lights in barrette.	1.50 m. max	1.00 m.	1.00 m.
- Number of lights in barrette.	Not specified	Five lights	Five lights
14.2 Side row lights			
- Longitudinal distance extended over from runway thershold.	270.00 m.	270.00 m. from threshold light bar.	270.00 m. from threshold light bar.
- Position of the innermost barrette.	30.00 m from runway threshold.	30.00 from threshold light bar.	30.00 m.from threshold light bar.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Longitudinal spacing	30.00 m.	30.00 m.	30.00 m.
- lateral spacing between siderow innermost lights.	18.00 m. min 22.50 m. max 18.00 m preferable, equal to that of touchdown zone lights.	Equal to that of touchdown zone lights	18.00 m (equal to that of the touchdown zone lights)
- Length of barrettes.	Equal to the length of touchdown zone light barrette.	3.00 m.	3.00 m. (equal to the length of touchdown zone light barrettes).
- Lateral spacing between lights in barrettes.	Equal to the lateral spacing between lights of touchdown zone light barrette.	1.50 m.	1.50 m. (equal to the lateral spacing between lights of touchdown zone light barrettes.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Number of lights in barrette	Not specified	Three lights	Three lights
14.3 Cross Bars 150-m. cross bar			
- Location	150.00 m from runway threshold	150.00 m. from threshold light bar	150.00 from threshold light bar.
- Lateral spacing between bar centerlines	Not specified	11.00 m.	11.00 m.
- Length of bar	Enough to fill gap between centerline lights and side rowlights.	4.50 m.	4.50 m.
- Lateral spacing between lights in bar.	2.70 m. max	1.50 m.	1.50 m.

CHAPTER-IV

NAVIGATIONAL AIDS

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
15. ELECTRONIC NAVIGATIONAL AIDS			
15.1 Localizers:			
a) Location	For Cat.II,Cat.III ILS Located on the extension of centre line of the Runway at stop end, the equipment shall be adjusted so that course lines will be in vertical plane containing the centre line of the Runway served Antenna shall give a minimum height to satisfy coverage requirements. Distance from stop end of Runway shall be consistent with safe obstruction clearance practice.	For Cat.II,Cat.III ILS The localizer antenna array is on the extended Runway Centre line 300m beyond far end of Runway.	ICAO Requirements
b) Clearance	Not Specified	i) On Level Terrain: Localizer antenna array installed at 300. distance and to the grading tolerance. ii) On Falling Terrain: The antenna array is 10.5m max.more above ground surface.	FAA Requirements

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Grading	For precision approach runway code number 3 or 4, the portion to be graded extends to a distance of 105m. from centre line except that distance is gradually reduced to 75m from centre line at both ends of strip for the length 1150m from Runway end.	Longitudinal grades:0.0 to 0.5% Transeverse grades: -0.5% max.	ICAO Requirements
15.3 Marker Beacons			
Size	A square counterpoise 9m x 9m at height of 1.8m	Not Specified	A square counterpoise 9m x 9m at height of 1.8m
Location	Not specified	i) Outer Marker Beacon located 7.4 to 13 km from ILS Runway threshold ii) Middle Marker Beacon located 600 to 1800 from ILS Runway iii) Inner Marker Beacon located not used for Catl ILS's	FAA Requirements
Clearance	Not specified	Standards Marker Beacon is 5.8m high installed in 8m x 8m tract situated on extended runway centre line.	FAA Requirements

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Grading	Not specified	Marker Beacon tracts should be smooth and level and well drained	FAA Requirements
15.4 Microwave Landing Systems:			
Location	Not specified	MLS azimuth and elevation units and marker beacons will be sited in locations comparable to the conventional ILS installations.	FAA Requirements
Clearance	Not specified	Clear line of site between MLS antennas and the approaching/ departing aircraft when MLS signed is used to define a missed apprach course.	FAAa Requirements
Grading	Not specified	Not required	Required

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
15.5 Non-directional Beacons:			
Location	Where locations are isntalled at both the middle and outer marker positions, they should be located where precticable on the same side of the extended centre line of the runway in order to provide a tract between the locators which will be more nearly parallel to the centre line of Runway.	i) A pole mounted antenna 11 m high ii) A symmetrical T-antenna, wires strung between two 20 m high poles spaced 105m apart. 30m min from metal building Power lines or metal fence	ICAO Requirements
Clearance	Not specified	Should not penetrate the approach or transitional surfaces. Wire Counterpoise buried 15cm below ground surface.	FAA Requirements
Grading	Not specified	Smooth level and well drained.	FAA Requirements
15.6 Distance Measuring Equipment (DME)			
Location	Not specified	Co-located with ILS localizer also co-located with TVOR.	FAA Requirements
Clearance	Not specified	Site clearacnes required for ILS localizer or for TVOR are adequate for DME antennas.	FAA Requirements

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Grading	Not speficied	No additional grading is required for DME facility	FAA Requirements
15.7 Terminal Very High Frequency Omni Range (TVOR)			
Size	Not specified	Standard TVOR has 16m diameter counterpoise	FAA Requirements
Location	Not specified	Located 150m min from centre line of Runway and 45m from centre line of taxiway.	FAA Requirements
Clearance	Not specified	TVOR Course signal is suscep -tible to distortions caused by reflection from structures, fences etc. Distance of the antenna from a) Structures 225m. b) Fences 150m c) Power Lines 360m	FAA Requirements

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Grading	Not specified	Surface should be cleared and reasonably smooth with no irregularities terrain should be level for radius of 600m min Max. downward slope 4% No upward slope is permitted.	
16. VISUAL AIDS			
16.1 Lead-in-Lighting System			
Spacing	Min 3 flashing lights spaced at 1600m interval	Min 3 flashing lights spaced 900m interval.	Required
Land Requirements	Not Specified	Varies	Required
Clearance Requirement	Not Specified	Not specified	Required
16.2 Visual Approach Slope Indicators			
Requirements	3-bar VASI-16 for major aiports	3-bar VASI-16 for major airports	PAPI shall be provided
Location/Spacing Downwind Bar	240m max behind the runway threshold.	240m behind the Runway Threshold	ICAO Required

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Upwind bar	Spaced at 300m max. and 105m max. for code No. 3 or 4.	Spaced at 300m interval behind the downwind bar.	Required
Distance of bar from Runway edge	15m.	15m. min.	15m. min.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Lateral Distance between bars	4.5m.	Not specified	4.5m.
Bar location	Bars located on left side of the runway	Bars are located on left side of the runway	Bars located on left side of runway
16.3 Precision Approach Path Indicator			
No. of Lights	Four Unit Bar	Four or two identical light Units	Required
Location	Left side of Runway in a line perpendicular to the certre line.	Left side of the Runway in a line perpendicular to the centre line	Required

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
16.4 Clearance from runway and taxiways	The inner edge of the unit nearest the runway is 15m (+ 1m) from runway edge. Unit should not be less than 14m to any taxiway, apron or runway.	The inboard light shall not be closer than 15m, (+10,-0) from runway edge onto other runways and taxiways.	Required
16.5 Lateral Spacing of Units	9m = ±1m	6 to 9m for L-880 System 3 to 6m for L-881 System	FAA Required
16.6 Distance from Threshold	Distance should not be less than that which provides minimum required wheel clearance over threshold.	Equal to the distance to the ILS slope plus additional (90m+15)	ICAO Required
17. TAXIWAY GUIDANCE SIGN SYSTEM	Required	Required	Required
17.1 Type of Signs			
- Mandatory instruction signs	Illuminated, when intended for use at night. Inscriptions in white on red background.	Illuminated reflective signs. Inscriotions in white on red background.	Illuminated reflective signs. Inscriptions in white on red background.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Information signs.	Illuminated or coated with reflecting materials when intended for use at night. Yellow inscription on black background or black inscription on yellow background.	Illuminated black legends on reflective yellow background	Illuminated black inscriptions on reflective yellow background
17.2 Location of Signs			
- Mandatory signs.			
- 'STOP' Sign	Atleast on the left side of the taxiway.	Not specified	On the leftside of the taxiway.
- 'NO ENTRY' Sign	At the begining of the area to which entrance is prohibited.	Not specified Left side of Taxiway	At the begining of the area to which entrance is prohibited.
- Cat.II or III holding position sign.	On each side of the hold position marking.	Preferably on the left side of the taxiway and in line with the hold line marking.	On each side of the hold line marking

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Information signs. - Location sign.	Prior to the intersection normally on the left side of the taxiway.	Prior to the intersection preferably on the left side of the taxiway.	Prior to the intersection and on the left side of the taxiway whenever possible.
- Destination sign.	Prior to the intersection and on the side of the direction to be followed.	Located so that it can be seen prior to entering the intersection and on the side of the direction to be followed.	Prior to the intersection and on the side of the direction to be followed.
17.3 Distance from signs to Taxiway and Runway Edge	18.00 m. and greater to prevents damage from jet blast	10.5 m. to 18.00 m. from pavement edge for large size sign.	18.00 m.
17.4 Size of Signs			
- Height from ground Level.	Large size sign: 1.05 m.	Size 3 Sign: 1.07 m.	1.05 m.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
- Height of panel.			
	Large Size Sign: 0.90 m.	Size 3 Signs: 0.76 m. min.	0.90 m.
- Length of panel.			
	Depends on length of wording	4.29 m max.	Variable
18. OBSTACLE LIGHTS			
18.1 Medium Intensity Obstacle Lights			
Spacing between the lights	45m max.	46m	Required
Effective Intensity	Min.1600/red lights	20,000 candellas	
Flash Frequency	20 to 60/min.	40 flashes/min. for L-865 60 Flashes/min. for L-866	FAA requirements
18.2 High Intensity Obstacle Lights			
Spacing between the lights	105m max.	153m.	Required
Effective Intensity	100,000 candellas	100,000 candellas	100,000 candellas
Flash Frequency	40 to 60/min.	40 Flashes/min. for L-856 60 Flashes/min. for L-857	40 to 60 per min.
18.3 Colour of Lights			
	Red	Red	Red

CHAPTER-V

MARKINGS

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
19. RUNWAY MARKINGS			
19.1 Designation Markings			
Desigation letters	Required for all runways	Required for all runways	Required
- Longitudinal distance from end of threshold marking.	12.00 m.	12.00m.	12.00 m.
- Length of letter	9.00 m. min.	18.00 m.	18.000 m.
- Width of letter	3.00 m. min.	6.00 m.	6.00 m.
Designation Numbers			
- Longitudinal distance from end of designation letter	6.00 m.	6.00 m.	6.00 m.
- Length of Number	9.00 m.	18.00 m.	18.00 m.
- Width of number	Variable (3.00 m. to 3.90 m.)	Variable (6.00 m. to 7.60 m.)	FAA requirements.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
19.2 Centerline Markings	Required for all runways	Required for all runways	Required
Longitudinal distance from end of designation marking.	12.00 m.	12.00 m.	12.00 m.
Length of stripe (dash)	30.00 m. min, at least equal to length of gap.	36.00 m.	36.00 m.
Combined length of stripe and gap.	Not less than 50 m, not more than 75 m.	60.00 m.	60.00 m
Width of stripe.	0.90 m. min.	0.90 m. min	0.90 m.
Length of gap (blank space).	20.00 m. min	24.00 m.	24.00 m.

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
19.3 Threshold Markings			
	Required for all runways	Required for all runways	Required
Longitudinal distance from runway threshhold	6.00 m.	6.00 m.	6.00 m
Lateral distance from runway centerline to outer edge of outermost stripe.	Stripes shall extend laterally to within 3m. of the edge of runway or a distance of 27m. on either side of Runway centre line. whichever results in the smaller distance.	19.50 m. (for runways 45 m. wide). For runways wider than 45 m, width of stripes and spaces between stripes maybe added to both sides	19.50 m.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Length of stripe.	30.00 m. min.	45.00 m.	45.00 m.
Width of Stripe	1.80 m. +	3.60 m.	3.6 m.
Lateral Spacing between:			
- Stripes nearest centerline	3.60 m. +	4.80 m.	4.80 m.
- Other Stripes	1.80 m. +	0.90 m.	0.90 m.
19.4 Fixed Distance Markings	Required for all runways of code letter A or B	Required for all runways used for turbojets	Required
19.5 Number of pairs			
- Three stripes	Two	Two	Two (one is replaced by fixed distance markings)
- Two stripes	Two	Two	Two

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
One stripe	Two	Two	Two
Length	45m-60m	45m	Required
Width	6m-10m	10m	Required
Lateral Spacing between inner sides	18m	21.6m	Required
19.6 Side Stripe Markings	Required for all precision approach runways	Required for precision instrument runways	Required
Distance between outer edges of side stripes	Equal to width of runway	Equal to width of runway	45 m.
Width of stripe	0.9m	0.15 m. min	0.30 m (same as guide lines to aircraft stand).

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
19.7 Extension of taxiway centerline marking beyond point of tangency for exit taxiways.	60.00 m. min.	60.00 m	60.00 m.
19.8 Spacing between centerlines of parallel taxiway and runway markings.	0.90 m.	0.90 m	0.90 m.
19.9 Edge Markings	Two parallel 0.15 m. thick stripes along taxiway edges	Two parallel 0.15 m. stripes along taxiway edges 0.15m aparts	ICAO and FAA requirements
19.10 Shoulder Markings	0.90 m. transverse stripes	0.90 m. transverse stripes	0.90 m. transverse stripes
Width of stripe	0.90 m. min.	0.90 m. min	0.90 m.

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
19.11 Shoulder Markings (Chevron Markings)	Not specified	Desirable	Required
19.12 Blast Pad Markings (Chevron Markings)	0.90 m. chevron markings at a 45. deg. angle with runway centerline, pointing in the direction of the runway, equally spaced at 30.00 m.	0.90 m. chevron markings at a 45. degree angle with runway centerline, pointing in the direction of the runway equally spaced at 30.00 m.	Required
20. TAXIWAY MARKINGS			
20.1 Centerline Markings	Required for all taxiways	Required for all Taxiways	Required
Width	0.15m.min	0.15m min.	ICAO Requirements
Location	On straight sections should be located along Taxiway centre line	Not specified	ICAO Requirements

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
	On Taxiway curve-marking should continue from straight portion of Taxiway at a constant distance from outside edge of curve	On taxiway curve-marking should continue from straight portion of Taxiway at a constant distance from outside edge of curve	ICAO Requirements
	At Intersection of Taxiway and Runway Marking should be entered parallel to the Runway centre line Marking for distance of 60m min. beyond the point of tangency	At Intersection of Taxiway and Runway Marking should be entered parallel to the Runway centre line Marking for distance of 60m min. beyond the point of tangency	ICAO Requirements
20.2 Taxiholding Position Taxiway and Runway Intersection	For single Taxiholding position at Intersection of Taxiway and precision approach Cat-II or III Runways pattern 'A' dictates	Required for Aircraft approach category 'C' & 'D' airplane group V precision instrument for most demanding Aircraft	ICAO Requirements

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
	For two or three taxiholding positions at intersections of taxiways and precision approach Cat-II or III runways, taxiholding Position farther from closest to Runway follow pattern A Position for the Runway follow Pattern B.	--	ICAO Requirements
Marking Pattern			
Pattern A	4 lines and 3 spaces 0.15m each	4 lines and 3 spaces 0.15m each	ICAO Requirements
Pattern B	2 lines at 0.3m each, 1 space at 0.6m	Not Specified	ICAO Requirements
Interval	45m max.	Not Specified	ICAO Requirements
Size and Spacing	1.8m min. height and should be placed at max. 0.9m beyond Holding position Marking	Not Specified	ICAO Requirements

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
Taxiway-Taxiway Intersection	Not Specified	4 lines and 3 spaces 0.15m each	FAA Requirements
21. APRON MARKINGS	Required	Required	Required
21.1 Edge Markings	Two parallel 0.15 m. stripes along apron edges.	Two parallel 0.15 m. stripes along apron edges.	ICAO and FAA requirements.
21.2 Guide lines to Aircraft Stands	0.15 m. (perferable 0.30 m) stripes.	Not specified	0.30 stripes
21.3 Reference lines (turn bar, stop line and alignment line)	0.15 m. min. stripes	Not specified	0.30 m. stripes

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
21.4 Apron Safety lines	0.10 m. min. stripes. Location defined by aircraft parking configuration and around facilities.	Not specified	ICAO requirements
22. PAINT COLORS			
22.1 Runway Markings	White. On runway surfaces of light color, the consipcuity of markings can be improved by outlining them in black	White. On runway surfaces of light color, the contrast of the markings can be increased by outlining with a back border atleast 0.15m. in width	White. On PCC pavements, mark shall be outlined with a 0.15 wide black border.
22.2 Runway Shoulder Markings	Not specified	Yellow	Yellow, which provides sufficient Contrast.
22.3 Runway Blast Pad Markings	Yellow	Yellow	Yellow, same as shoulder and blast pad markings.

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
22.4 Taxiway Markings, Guidelines to Aircraft Stands and Reference lines to Apron	Yellow	Yellow	Yellow Same as shoulder blast pad
22.5 Apron Safety Lines	Conspicuous color which contrast with that used for aircraft stand markings	Not specified	White, On PCC pavements, markings be outlined with a 0.15 m. wide black border.
23. OBSTRUCTION MARKINGS (ICAO)			
23.1 Fixed Object			
23.2 Dimensions of Pattern	One Dimension Horizontal or Vertical > 1.5m Other Dimension Horizontal or Vertical < 4.5m	Horizontal and Vertical Dimension 3.2m max.	ICAO Requirements
Width of the band	30m.	Not Specified	ICAO Requirements

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
23.3 Color Pattern	Orange and White or alternatively red and white exvept where such colors merge with background	Alternating rectangles of aviation orange and white. Checkered board rectangles measure 1.5m min. 6m max. Corner surfaces coloured orange	FAA Requirements
23.4 Markers			
23.5 Diameter of the Marker	60m	0.91m min.	ICAO Requirements
23.6 Spacing	30m max. for 0.6m dia 35m max. for 0.8m dia 40m max. for 1.30m dia	61m.	ICAO Requirements
23.7 Flags for fixed objects	0.6 sqm. min.	0.6m min or each side	0.6m min. on each side

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
23.8 Color Patterns of Flag	Orange and white or Red and white chequered	Orange and white for Triangular sections. Aviation orange for solid.	Orange and White or Red and White chequered
23.9 Dimension of Squares	0.3m min.	0.3m.	0.3m
23.10 Band Width Marking of Structure for:			
1/7th of longest dimension	214m max.	214m max.	214m max.
1/9th of longest dimension	275m max.	275m max.	275m max.
1/11th of longest dimension	336m max.	336m max.	336m max.
1/13th of longest dimension	397m max.	397m max.	397m max.

CHAPTER-VI

WIND DIRECTION INDICATOR

ITEM	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
24. WIND DIRECTION INDICATORS	Required	Required	Required
24.1 Number and Location	Atleast one in an aerodrome, located so as to be visible from aircraft in flight or on the movement area.	Number and location of Standard wind direction indicators not specified Supplemental wind direction indicators located near runway end or touchdown zone areas.	One wind direction indicatorper touchdown zones area.
24.2 Size of Wind Cone	3.60 m. min. length, 0.90.m. min. throat diameter.	3.65 m. min. length 0.91 m. min. throat diameter (Standard wind cones)	3.75 m. length 0.90 m. throat diameter.

I T E M	ICAO STANDARDS	FAA STANDARDS	PAKISTAN STANDARDS
24.3 Marker	Atleast one wind direction indicator is marked by a circular band 15 m. in diameter and 1.2 m. wide	A 30 m. diameter circle of atleaset 18 segments around wind direction indicator.	A segmented circle marker 30 m. in diameter and 1.2 m. in width shall be provided for each wind direction indicator.
24.4 Lighting	Atleast one wind indicator lighted at an aerodrome intended for use at night	Wind indicator lighted so that it is visible for night oprations	All wind direction indicators shall be lighted.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

1) Physical Characteristics

The standards for Runway Lengths, Widths and Slopes, Runway Shoulders, Runway End Safety Areas, Taxiways, Taxiway stripes in terms of Widths, Slopes followed by ICAO and FAA are more or less same. As such the same standards may be proposed for Pakistan.

The size of Aprons as regards handling of aerodrome traffic at its maximum anticipated density, size and configuration of aircraft and slopes of Aprons are basic requirements for the proposed standards for aprons.

2) Airfield Lights

As regards Runway Light, Runway Edge Lights, Wing Bar Lights, Threshold Lights, Runway Centreline Lights, Touch Down Zone Lights, Taxiway Centerline lights, Stop Bars and Clearance Bars, in terms of longitudinal/lateral spacings, No. of lights, distance of light from Runway and Taxiway Edges, the standards adopted by ICAO and FAA are identical and same may be proposed for Pakistan. Lighting Configuration for apron followed by ICAO and FAA are identical and may be proposed for Pakistan.

Approach Lighting systems. For precision approach Cat-II. Lighting System following by ICAO longitudinal distance of centreline extended over from runway, threshold is 900m. Compared with ICAO, FAA High Intensity system ALSF-II recommends 900m longitudinal of Centreline lights extended over from Runway Threshold if the Glide Slope angle is less than 2.75 degrees. 900m may be proposed for Pakistan.

3. Electronic Navigational Aid/Radio Navigational Aids

Location for ILS locatizers for Cat-II, III, followed by ICAO and Clearnace and Grading requirements for ILS localizer followed by FAA may be proposed for Pakistan. Clearance and Grading requirements for Glide Path followed by ICAO may be proposed for Pakistan. Clearance and Grading requirements for Marker Beacons followed by FAA may be proposed for Pakistan.

Micro-Wave landing System: Site requirements of MLS adopted by FAA may be proposed for Pakistan.

Non-Directional Beasons: Locations of NDB followed by ICAO and Clearance and Grading requirements followed by FAA may be proposed for Pakistan.

Distance Measuring Equipment: Requirements for Location, Clearance and Grading for Distance Measuring Equipment (DME) and Terminal Very High Freequency Omni Range (TVOR) adopted by FAA may be proposed by Pakistan.

Secondary Surveillance Radar Standards adopted by ICAO and Primary Surveillance Radar (ASR-4) Standards adopted by FAA may be proposed for Radio Navigational facilities for Pakistan.

Visual Aids

Approach Lighting System: Clearance requirements for ALS followed by ICAO and FAA are identical and same may be proposed for Pakistan.

Lead-in-Lighting system: ICAO requirements may be proposed for Lead in Lighting system for Pakistan.

Visual Approach Slope Indicator: Precision Approach paths Indicator may be adopted for Pakistan.

4) Obstacle Lights

Standards for Medium and High Intensity Obstacle Lights followed by ICAO and FAA may be proposed for Pakistan.

5) Markings

Runway, Taxiway and Apron Marking Standards adopted by ICAO and FAA are identical and same could be adopted for Pakistan. Obstruction Marking Standards followed by ICAO and Color Pattern followed by FAA may be proposed for Pakistan.

6) Wind Direction Indicators.

Atleast one wind direction indicator is proposed for Pakistan as recommedned by ICAO.

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9) AC 150/5340-24: Runway and Taxiway Edge Lighting System (3 Sept 75) including change 1 (25 Nov 77).

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16) AC 150/5340-23 A: Suppplemental Wind Cones (24 June 75).

17) AC 150/5345-27B: Specification for Wind Cones Assembilies (19 Mar 82).