Introduction of PCR at RSI -

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ASPIG/7

Riyadh, April 2025

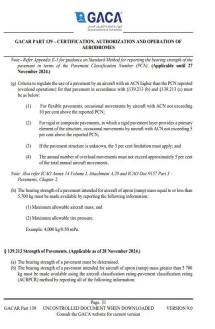






Introduction

Red Sea International Airport (RSIA) under GACAR 139 Version 9.0 & Ref. to ICAO Annex 14, 2.6.2 was required to make available the bearing strength information of all its pavements in the aerodrome using the new Aircraft Classification Rating – Pavement Classification Rating (ACR-PCR) method.



(1)	Pavement classification rating (PCR) and numerical value;
(2)	Pavement type for ACR-PCR determination;
(3)	Subgrade strength category;
(4)	Maximum allowable tire pressure category or maximum allowable tire pressure value and
(5)	Evaluation method.
or less th	t reported must indicate that aircraft with an aircraft classification rating (ACR) equal to han the reported PCR may operate on the pavement subject to any limitation on the tire or aircraft all-up mass for specified aircraft type(s).
(d) The ACI with the (e) For the	ACR-PCR method. purposes of determining the ACR, the behavior of a pavement must be classified as
(d) The ACI with the (e) For the equivale (f) Informat	R of an aircraft must be determined in accordance with the standard procedures associated ACR-PCR method. purposes of determining the ACR, the behavior of a pavement must be classified as the a rigid of Televible construction. ion on pavement type for ACR-PCR determination, subpract strength category, an allowable tire pressure category and evaluation method must be reported using the
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GACA

GACAR PART 139 – CERTIFICATION, AUTHORIZATION AND OPERATION OF AERODROMES			
represen MPa and	ngth: characterized by by E = 80 MPa and ting a range in E values equal to or above 60 strictly less than 100 MPa MPa for rigid or pavements.	С	
Ultra Lo represen	w strength: characterized by E = 50 MPa and ting all E values strictly less than 60 MPa for flexible pavements.	D	
(3)	Maximum allowable tire pressure category:		
		Code	
Unlimite	ed: no pressure limit	W	
High: pr	essure limited to 1.75 MPa	X	
Medium	: pressure limited to 1.25 MPa	Y	
Low: pro	essure limited to 0.50 MPa	Z	
(4)	Evaluation method:		
(.)		Code	
Technica characte serve.	al evaluation: representing a specific study of the pavement ristics and types of aircraft which the pavement is intended to	T	
Using ai	rcraft experience: representing a knowledge of the specific type s of aircraft satisfactorily being supported under regular use.	U	
	regulate the use of a povement by an aircraft with an ACR higher the venent in accordance with §19.9213 (c) must be. For flexible and rigid povements, occasional movements by aircr acceeding 10 percent above the reported PCR should not adverse pavement; and The annual number of overload movements must not exceed apper of the total annual movements excluding light aircraft.	as below: aft with ACR not ly affect the	

Annex 14 — Aerodromes	Volume I	Chapter 2	Anne
2.6 Strength of pavements Applicable as of 28 November 2024.		b) Subgrade strength category:	
2.6.1 The bearing strength of a pavement shall be determined.		High strength: characterized by E = 200 MPa. 150 MPa, for rigid and flexible pavements.	and representing all E values equal to or above
2.6.2 The bearing strength of a pavement intended for aircraft of apron (ramp) mass greater made available using the aircraft classification rating-pavement classification rating (ACR-PCR) m		Medium strength: characterized by E = 120 M to or above 100 MPa and strictly less than 150	
the following information:		Low strength: characterized by E = 80 MPa at above 60 MPa and strictly less than 100 MPa,	
a) pavement classification rating (PCR) and numerical value; b) pavement type for ACR-PCR determination;		Ultra-low strength: characterized by E = 50 I than 60 MPa, for rigid and flexible pavements.	MPa and representing all E values strictly less
c) subgrade strength category;		c) Maximum allowable tire pressure category:	
d) maximum allowable tire pressure category or maximum allowable tire pressure value; and		Unlimited: no pressure limit	
e) evaluation method.		High: pressure limited to 1.75 MPa	
		Medium: pressure limited to 1.25 MPa	
Note.— Guidance on reporting and publishing of PCRs is contained in the Acrodrome Desi Part 3).	ign Manual (Doc 9157,	Low: pressure limited to 0.50 MPa	
2.6.3 The PCR reported shall indicate that aircraft with an aircraft classification rating (ACR)		Note.— See Note 5 to 10.2.1 where the pave the upper categories.	ement is used by aircraft with tire pressures in
reported PCR may operate on the pavement subject to any limitation on the tire pressure or aircraft a aircraft type(s).	are or aircraft all-up mass for specified	d) Evaluation method:	
Note.— Different PCRs may be reported if the strength of the pavement is subject to significant so		Technical evaluation: representing a specific types of aircraft which the pavement is intende	study of the pavement characteristics and the
2.6.4 The ACR of an aircraft shall be determined in accordance with the standard procedu ACR-PCR method.	res associated with the	Using aircraft experience: representing a know satisfactorily being supported under regular us	wledge of the specific type and mass of aircraft
Note.— The standard procedures for determining the ACR of an aircraft are given in the Act (Doc 9157), Part 3. For convenience, dedicated software is available on the ICAO website for compa any mass on rigid and flexible pavements for the four standard subgrade strength categories detailed	ting any aircraft ACR at	Note.— The following examples illustrate how p Further guidance on this topic is contained in the Acros	
2.6.5 For the purposes of determining the ACR, the behaviour of a pavement shall be classified or flexible construction.	as equivalent to a rigid	Example 1.— If the bearing strength of a rigid pay technical evaluation to be PCR 760 and there is no tire p	
2.6.6 Information on pavement type for ACR-PCR determination, subgrade strength category, a pressure category and evaluation method shall be reported using the following codes:	maximum allowable tire	PCR 760 / R / B / W / T	
Pavement type for ACR-PCR determination: a) Pavement type for ACR-PCR determination:	Code	Example 2.— If the bearing strength of a composit strength subgrade, has been assessed by using aircraft of 1.25 MPa, then the reported information would be:	
Rigid pavement	R	PCR 550 / F / A / Y / U	
Flexible pavement	F	Note.— Composite construction,	
Note.— If the actual construction is composite or non-standard, include a note to the effect (see example 2 below).	at	2.6.7 Recommendation.— Criteria should be e ACR higher than the PCR reported for that pavement in	
		Note.— Attachment A, Section 19, details a simp Design Manual (Doc 9157), Part 3, includes the descr their suitability for restricted overload operations.	

GACAR 139, Vs.9.0

Annex 14, 9th Edition, July 2022 Section 2.6.2

Annex 14 - Aerodromes

enoth data are reported under the ACR-PCR method

no on a medium-strength subgrade, has been assessed by

behaving like a flexible pavement and resting on a high be PCR 550 and the maximum allowable tire pressure is

regulate the use of a pavement by an aircraft with an





Introduction:

ICAO Doc 9157 -

Part 3, Chapter 3, Sec. 3 –

This gives provides guidance on the design of pavements, including their characteristics, and on evaluating and reporting on the bearing strengths of pavements... including the ACR-PCR Method.

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RS

Introduction

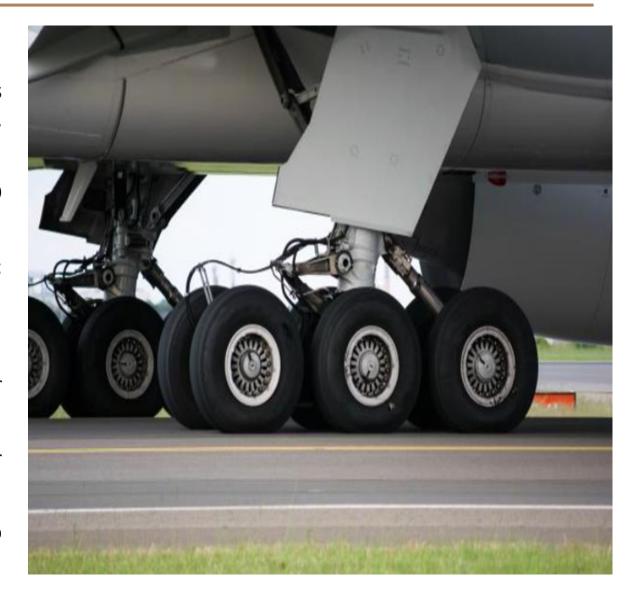
This ACR-PCR method replaced the ACN-PCN Method as the official ICAO pavement rating system by November 28, 2024.

This method was developed in cooperation with ICAO Aerodromes Pavement Expert Group (APEG).

The method uses similar concepts as the ACN-PCN method; however, the ACR-PCR method:

- Is based on fully layered elastic analysis,
- Uses uniform & standard subgrade categories for both flexible and rigid pavement, and
- Eliminates the use of alpha factor, layer equivalency factors top of base, etc.

This slide presentation provides an insight and details into the ACR-PCR method used at Red Sea International Airport.



Introduction

The ACR and PCR are defined as follows:

- 1. ACR is a number that expresses the relative structural effect of an aircraft on different pavement types for specified standard subgrade strengths based on the combined result of aircraft wheel loads, tyre pressures and landing gear geometry. The ACR is published by aircraft manufacturers.
- 2. PCR is a number expressing the bearing strength of a pavement for unrestricted operations.
- 3. The PCR is computed based on the accumulated pavement damage produced by entire traffic mix (CDF Concept)
- 4. The (subgrade) cumulative damage factor (CDF) is the amount of the structural fatigue life of a pavement which has been used up. It is expressed as the ratio of applied load repetitions to allowable load repetitions to failure, or, for one airplane and constant annual departures.

The system is structured so that a pavement with a particular PCR value can support, without weight restrictions, an aircraft that has an ACR value equal to or less than the pavement's PCR value.

ACR is the Aircraft Classification Rating and PCR is the Pavement Classification Rating.

Introduction

Additional points to note:

- The ACR-PCR system follows the proposed amendment to GACAR § 139.213 Strength of Pavements. (Applicable as of 28 November 2024, replacing the current ACN-PCN system (Also refer to ICAO Annex 14).
- An aircraft having an ACR equal to or less than the PCR can operate on the pavement subject to any limitation on the tire pressure (similar to the ACN-PCN).
- The ACR-PCR system ensures that both aircraft and pavement can be utilized to their maximum extend without detrimental effects.
- According to the Aerodrome Design Manual, Part 3 the method is meant only for publication of pavement strength data in the Aeronautical Information Publication (AIPs).
- The ACR has been developed for two types of pavements, flexible and rigid, and for four levels of subgrade strength categories. The PCR has the same types of pavements and four levels of subgrade strengths.

	CAT A High	CAT B Medium	CAT C Low	CAT D Ultra-low
ACR (flexible & rigid)	E = 200 MPa	E = 120 MPa	E = 80 MPa	E = 50 MPa
ACN (flexible)	CBR 15	CBR 10	CBR 6	CBR 3
ACN (rigid)	K = 150 MN/m3	K = 80 MN/m3	K = 40 MN/m3	K = 20 MN/m3

Background

- Core principles of ACR-PCR same as ACN-PCN
- ICAO Task Group: ACI World, US FAA, DGAC France, Boeing and Airbus



ICAO - ACR-PCR Journey to Implementation

Key Features in summary

- The ACR-PCR method is meant only for the publication of pavement strength data in aeronautical information publications (AIPs)
- It is not intended for the design or evaluation of pavements
- It does not require the use of a specific method by the aerodrome operator
- It shifts the emphasis from the evaluation of pavements to the evaluation of the load rating of aircraft (ACR)
- Includes a standard procedure for the evaluation of the load rating of aircraft
- The strength of a pavement is reported in terms of the load rating of the aircraft on an unrestricted basis
- The PCR is also a number which represents the load-bearing strength of the pavement in terms of the highest ACR which can be accepted on the pavement for unrestricted use.
- Unrestricted operations does not mean unlimited operations
 - ✓ It refers to the relationship of the PCR to the aircraft ACR and it is permissible for an aircraft to operate without weight restrictions (subject to tire pressure limitations) when the PCR is greater than or equal to the ACR

Summary of What is not Changing?

- ACR will still need to be calculated on the basis
 - ✓ Aircraft weight
 - ✓ Subgrade Strength based on 4 categories A, B, C and D
 - ✓ Type of pavement, Flexible and Rigid
- PCR will still be declared on the basis of 5 attributes:
 - ✓ Number linked to ACR
 - ✓ Pavement Type
 - ✓ Subgrade Strength
 - ✓ Tyre Pressure Limitation
 - ✓ Type of declaration

- The comparison of ACR and PCR similar to the core principle of the ACN-PCN method has not changed:
 - ✓ If ACR ≤ PCR, the aircraft can operate on the pavement without restriction
 - ✓ If ACR > PCR, the aircraft may be excluded, or may be allowed to operate subject to weight and/or frequency limitations

Summary of What is Changing

- The procedures and models used for determining the ACR and PCR have changed
- Based on rational models allowing the calculation of pavement mechanical response (surface deflections, internal stresses, strains within the pavement) induced by surface traffic loads from Layered Elastic Analysis (LEA)
 - ✓ Not CBR or Westergaard methods
- Pavement damage is quantified based on a specific damage model, using as an input these responses (especially strains for flexible pavements and stresses for rigid pavements)
- Use of the Cumulative Damage Factor (CDF) concept
- The CDF is:
 - The amount of structural fatigue life of a pavement that has been used up.
 - Expressed as the ratio of applied load repetitions to allowable load repetitions to failure.
- Damage from multiple aircraft types can be accounted for by summing the CDF for each aircraft in the traffic mix in the application of Miner's rule for the prediction of fatigue life in structures.

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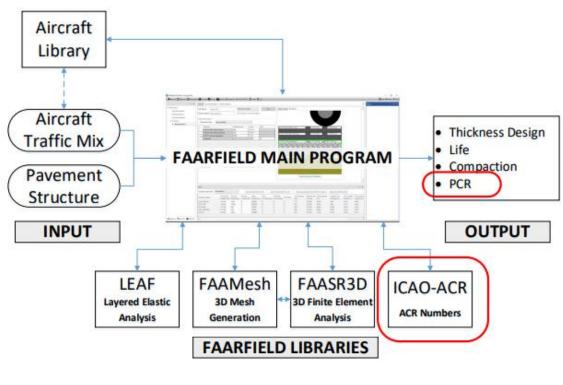
Summary of What is Changing

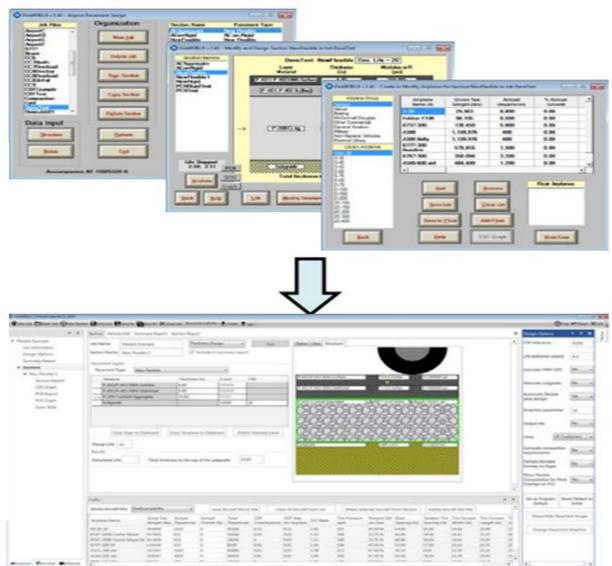
- Same subgrade categories apply to both flexible and rigid pavements, and
- The grouping of subgrades with a standard value at the mid-range of each group, considered to be entirely adequate as follows:

Subgrade Category	Flexible and Rigid Pavement Subgrade Characteristic E Modulus	
A - High	200 MPa	
B - Medium	120 MPa	
C - Low	80 MPa	
D – Ultra Low	50 MPa	

ICAO new procedure for ACR / PCR:

Directly uses FAA FAARFIELD software (Daa Dublin Software)





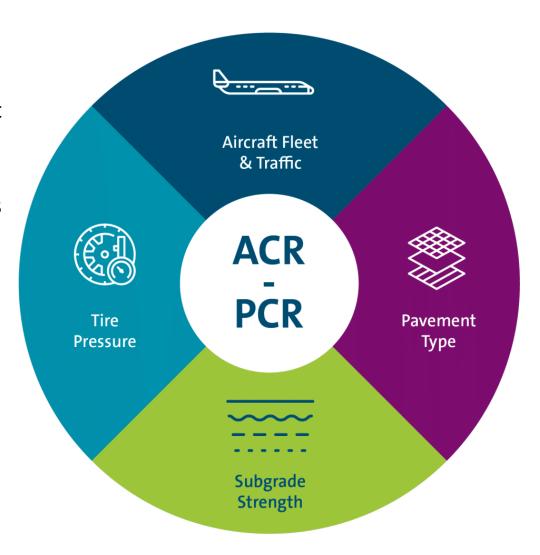
ICAO new procedure for ACR / PCR:

Directly uses FAA FAARFIELD software (Daa Dublin Software)

Inputted/Required Data for the ACR- PCR Calculations at RSIA are but not limited to:

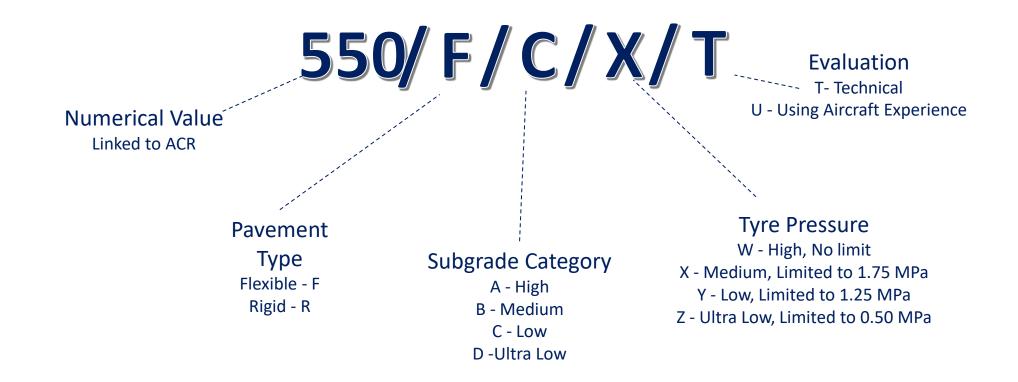
- 1. Flight Mix which is based off the data for the mix of aircraft that use the RSIA aerodrome runway and taxiways at RSIA, including:
 - 1. The Code of the aircraft.
 - 2. The no of weekly arrival/departure movements.

- 3. The number of annual departures.
- 2. The pavement data for both runways and taxiways, including:
 - 1. The layer types,
 - 2. Thickness of these layers.
 - 3. Modulus of the layer in Mpa.
- 3. The type of pavement surface flexible or rigid.
- 4. Subgrade strength information and details.



New PCN Method – Pavement Classification Rating (PCR):

A PCR is reported in a five-part format. Apart from the numerical value, notification is also required of the pavement type (rigid or flexible), the subgrade support category, the maximum allowable tyre pressure, and whether the assessment has been made by a technical evaluation or from past experience of aircraft using the pavement.



RSI Airfield Manual

New PCR shall be calculated and declared for the following:

- Yearly revalidation of the PCR values based on the present pavement strengths
- Yearly revalidation of the PCR values based on the fleet mix (types, numbers of and increased sizes of aircraft operations)
- Major rehabilitation or reconstruction of the aircraft pavement
- Major change of aircraft fleet mix for the aerodrome
- Periodically throughout pavement life as part of pavement management program and if premature structural distress observed on the pavement

**The Pavement Classification Rating (PCR) of all new or rehabilitated aircraft pavements shall be declared in accordance with the ICAO classification and a PCR map produced **





RSI Pavements PCR Values:

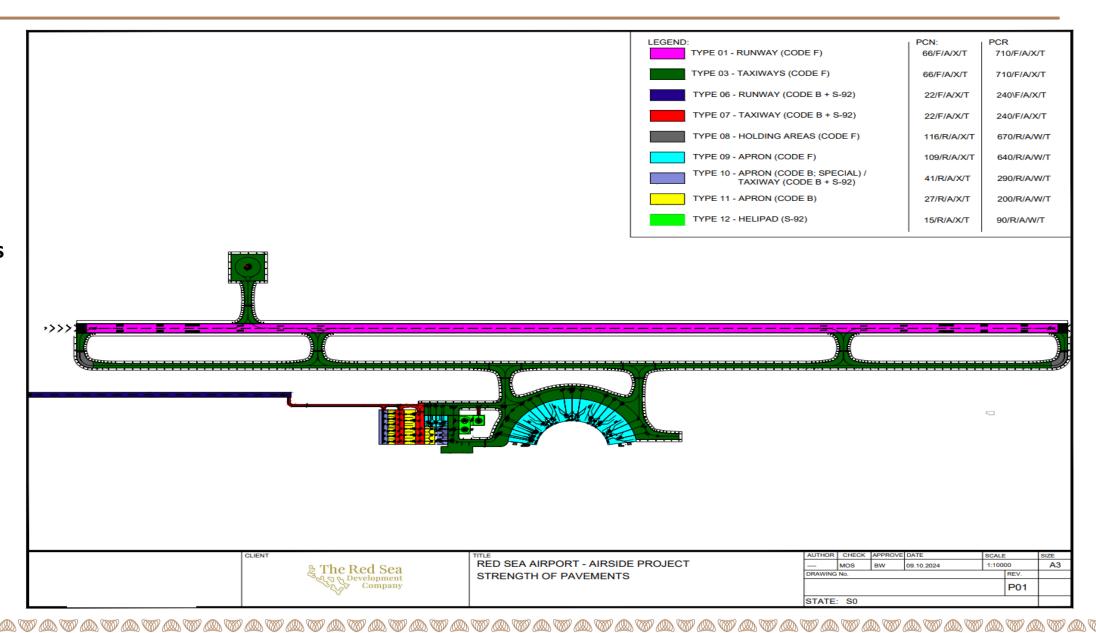
The table showing the Red Sea International Airport runway pavements PCR values as per:

- GACAR 139, Vs.9.0, and
- ICAO Annex 14, Section 2.6.2

Pavement Type	Designation	Code	Surface	Strength	
01	15L/33R (CAT4F)	F	ASPH	PCR	710/F/A/X/T
03	A1	F	ASPH	PCR	710/F/A/X/T
03	A2	F	ASPH	PCR	710/F/A/X/T
03	A3	F	ASPH	PCR	710/F/A/X/T
03	A4	F	ASPH	PCR	710/F/A/X/T
03	A5	F	ASPH	PCR	710/F/A/X/T
03	A6	F	ASPH	PCR	710/F/A/X/T
03	A7	F	ASPH	PCR	710/F/A/X/T
03	A8	F	ASPH	PCR	710/F/A/X/T
03	A10	F	ASPH	PCR	710/F/A/X/T
03	С	F	ASPH	PCR	710/F/A/X/T
03	D	F	ASPH	PCR	710/F/A/X/T
03	E	F	ASPH	PCR	710/F/A/X/T
03	F	F	ASPH	PCR	710/F/A/X/T
06	15L/33R (CAT4F)	B & S92	ASPH	PCR	240/F/A/X/T
07	В	B & S92	ASPH	PCR	240/F/A/X/T
07	G	B & S92	ASPH	PCR	240/F/A/X/T
07	Н	B & S92	ASPH	PCR	240/F/A/X/T
08	A9	F	CONC	PCR	670/R/A/W/T
09	APRON	F	CONC	PCR	640/R/A/W/T
10	APRON	B & Specials	CONC	PCR	290/R/A/W/T
10	I	B & S92	CONC	PCR	290/R/A/W/T
11	APRON	В	CONC	PCR	200/R/A/W/T
12	Helipad	S-92	CONC	PCR	90/R/A/W/T

RSI Pavements PCR

Overall
Pavement
Drawing
for RSI as
per ICAO.

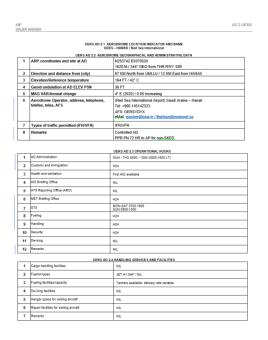




RSI Pavements PCR Values:

The result of the conversion from ACN-PCN to ACR-PCR has been confirmed by:

- GACA via their letter shown here, and
- The publishing of the corresponding values in the AIP as shown in the snapshots of the AIP in alignment with the drawing in the previous slide.









الموقر





نسخة لسعادة مدير عام سلامة الملاحة الجوية الموقد

السلام عليكم ورحمة الله وبركاته،،،

سعادة الرئيس التنفيذي لمطار البحر الأحمر الدولي

إشارة إلى خطاب سعادتكم المقيد لدى الهيئة برقم ١٠٣٨١ وتاريخ ٢٠٢٥/٠١/٠٤م، بخصوص طلب الموافقة على نشر بيانات (PCR) لمطار البحر الأحمر الدولي بدليل معلومات الطيران السعودي (AIP). فقيد سعادتكم أنه لا مانع لدى الهيئة العامة للطيران المدني من نشر بيانات (PCR) لمطار البحر الأحمر الدولي بدليل معلومات الطيران السعودي، وذلك بالتنسيق مع شركة خدمات الملاحة البحوية السعودية.

وتقبلوا وافر التحية والتقدير "

مدير عام سلامة المطارات

على بن سعود آل ذياب



السلكة العربية السعونية ، مقلف: ۱۳۶۸-۱۰ ما للكري: ۱۳۵۲-۱۳۱۲- رقم الميني : ۲۵۱۱ الرمز البريدي : ۲۵۱۳ الرقم الانستاني : ۲۸۱۹ Kingdom of Saudi Arabia, Building No 8691 Zip code 13443 Additional No 3819 Tel : 8001168888 Fax : +9661152532 Geac.gov.sa

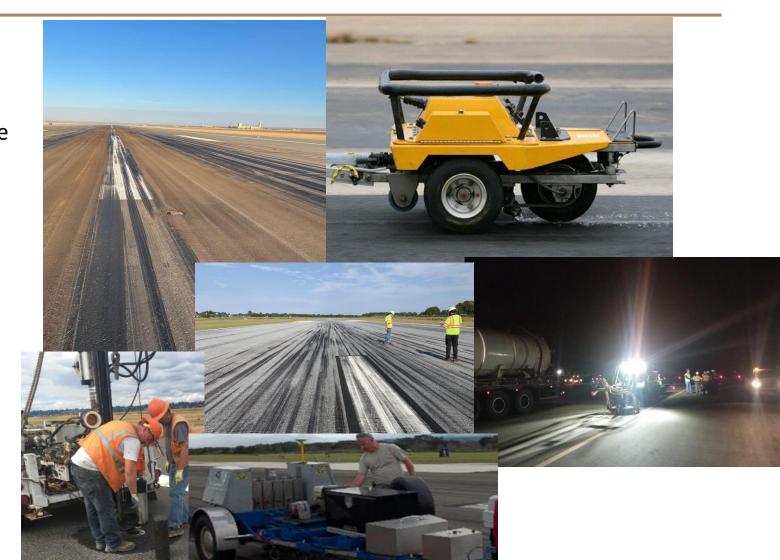
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RSI Pavements Training:

Additional to the conversion and implementation of the ACR –PCR values for the RSI Airport.

The Airport Operator has embarked on the trainings for key operations & maintenance personnel, with ACI on:

- Aerodrome Pavement Evaluation
- Aerodrome Pavement Design
- Aerodrome Pavement Construction
- Aerodrome Pavement Maintenance



Thank You

