AIRPORT STANDARDS DIRECTIVE 513
[ASD 513]

PAVEMENTS MAINTENANCE

AIRPORTS STANDARD DIVISION
DEPARTMENT OF CIVIL AVIATION MALAYSIA

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INTRODUCTION

This Airport Standards Directive contains specifications that prescribe the pavement maintenance that shall be provided at aerodrome

This Directive has been written in general terms. Specific advice could be obtained from the Authority at:

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OBJECTIVE

This Airport Standards Directive [Directive] is intended to serve guidance to aerodrome operators pertaining to ICAO mandatory requirement on the pavement maintenance of aerodromes.

The implementation of this Directive will ensure facilities, equipments and operational procedures at certified aerodromes are in compliance with SARPS specified in Annex 14 to the Convention on International Civil Aviation, and to national standards and practices as defined under Airport Standards Directives published by Director General of Civil Aviation.

APPLICABILITY

The specification in this directive shall apply for aerodromes used for international operations, in any state of Malaysia.

AUTHORITY

The Authority is the Director General of Civil Aviation Malaysia under the provision of Section 2B, 2C and 24O Civil Aviation Act 1969 (Act 3).

1. GENERAL

1.1 A maintenance programme, including preventive maintenance where appropriate, shall be established at an aerodrome to maintain facilities in a condition which does not impair the safety, regularity or efficiency of air navigation.

Preventive maintenance is programmed maintenance work done in order to prevent a failure or degradation of facilities.

"Facilities" are intended to include such items as pavements, visual aids, fencing, drainage systems, electrical systems and buildings.

1.2 The design and application of the maintenance programme should observe Human Factors principles.

Guidance material on Human Factors principles can be found in the Human Factors Training Manual (Doc 9683) and in the Airport Services Manual (Doc 9137), Part 8.

2. PAVEMENTS

2.1 The surfaces of all movement areas including pavements (runways, taxiways and aprons) and adjacent areas shall be inspected and their conditions monitored regularly as part of an aerodrome preventive and corrective maintenance programme with the objective of avoiding and eliminating any loose objects/debris that might cause damage to aircraft or impair the operation of aircraft systems.

Guidance on carrying out daily inspections of the movement area is given in the Airport Services Manual (Doc 9137), Part 8, the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and the Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830).

Additional guidance on sweeping/cleaning of surfaces is contained in the Airport Services Manual (Doc 9137), Part 9.

Guidance on precautions to be taken in regard to the surface of shoulders is given in Attachment A, Section 9, and the Aerodrome Design Manual (Doc 9157), Part 2.

Where the pavement is used by large aircraft or aircraft with tire pressures in the upper categories referred to in 2.6.6 c), particular attention should be given to the integrity of light fittings in the pavement and pavement joints.

2.2 The surface of a runway shall be maintained in a condition such as to prevent formation of harmful irregularities.

See Attachment A, Section 5.

2.3 A paved runway shall be maintained in a condition so as to provide surface friction characteristics at or above the minimum friction level. Table 1 shows the acceptable friction level with different friction-measuring devices.for new or resurfaced runway surfaces, for maintenance planning levels and for minimum friction levels.

Table 1 Runway surface condition levels

Test equipment	Test tire		Test speed (km/h)	Test water depth (mm)	Design objective for new surface	Maintenance planning level	Minimum friction level
	Type	Pressure (kPa)					
(1)	(2)		(3)	(4)	(5)	(6)	(7)
Mu-meter Trailer	A	70	65	1.0	0.72	0.52	0.42
	A	70	95	1.0	0.66	0.38	0.26
Skiddometer Trailer	B	210	65	1.0	0.82	0.60	0.50
	B	210	95	1.0	0.74	0.47	0.34
Surface Friction Tester Vehicle	B	210	65	1.0	0.82	0.60	0.50
	B	210	95	1.0	0.74	0.47	0.34
Runway Friction Tester Vehicle	B	210	65	1.0	0.82	0.60	0.50
	B	210	95	1.0	0.74	0.54	0.41
TATRA Friction Tester Vehicle	B	210	65	1.0	0.76	0.57	0.48
	B	210	95	1.0	0.67	0.52	0.42
RUNAR Trailer	B	210	65	1.0	0.69	0.52	0.45
	B	210	95	1.0	0.63	0.42	0.32
GRIPTESTER Trailer	C	140	65	1.0	0.74	0.53	0.43
	C	140	95	1.0	0.64	0.36	0.24

The Airport Services Manual (Doc 9137), Part 2, contains further information on this subject, on improving surface friction characteristics of runways.

2.4 Runway surface friction characteristics for maintenance purposes shall be periodically measured with a continuous friction measuring device using self-wetting features and documented. The frequency of these measurements shall be sufficient to determine the trend of the surface friction characteristics of the runway.

Guidance on evaluating the friction characteristics of a runway is provided in Attachment A, Section 7. Additional guidance is included in the Airport Services Manual (Doc 9137), Part 2.

The objective of 2.3 to 2.6 is to ensure that the surface friction characteristics for the entire runway remain at or above a minimum friction level.

Guidance for the determination of the required frequency is provided in Attachment A, Section 7 and in the Airport Services Manual (Doc 9137), Part 2, Appendix 5.

2.5 Corrective maintenance action shall be taken to prevent the runway surface friction characteristics for either the entire runway or a portion thereof from falling below a minimum friction level.

A portion of runway in the order of 100 m long may be considered significant for maintenance or reporting action.

2.6 When there is reason to believe that the drainage characteristics of a runway, or portions thereof, are poor due to slopes or depressions, then the runway surface friction characteristics should be assessed under natural or simulated conditions that are representative of local rain, and corrective maintenance action should be taken as necessary.

2.7 When a taxiway is used by turbine-engined aeroplanes, the surface of the taxiway shoulders should be maintained so as to be free of any loose stones or other objects that could be ingested by the aeroplane engines.

Guidance on this subject is given in the Aerodrome Design Manual (Doc 9157), Part 2.

3. REMOVAL OF CONTAMINANTS

3.1 Standing water, mud, dust, sand, oil, rubber deposits and other contaminants shall be removed from the surface of runways in use as rapidly and completely as possible to minimize accumulation.

3.2 Taxiways should be kept clear of standing water, etc., to the extent necessary to enable aircraft to be taxied to and from an operational runway.

3.3 Aprons should be kept clear of standing water, etc., to the extent necessary to enable aircraft to manoeuvre safely or, where appropriate, to be towed or pushed.

3.4 Whenever the clearance of standing water, etc., from the various parts of the movement area cannot be carried out simultaneously, the order of priority after the runway(s) in use should be set in consultation with the affected parties such as rescue and fire fighting service.

4. RUNWAY PAVEMENT OVERLAYS

The following specifications are intended for runway pavement overlay projects when the runway is to be returned temporarily to an operational status before resurfacing is complete. This may necessitate a temporary ramp between the new and old runway surfaces. Guidance on overlaying pavements and assessing their operational status is given in the Aerodrome Design Manual (Doc 9157), Part 3.

4.1 The longitudinal slope of the temporary ramp, measured with reference to the existing runway surface or previous overlay course, shall be:

a) 0.5 to 1.0 per cent for overlays up to and including 5 cm in

thickness; and

b) not more than 0.5 per cent for overlays more than 5 cm in

thickness.

4.2 Overlaying should proceed from one end of the runway toward the other end so that based on runway utilization most aircraft operations will experience a down ramp.

4.3 The entire width of the runway should be overlaid during each work session.

4.4 Before a runway being overlaid is returned to a temporary operational status, a runway centre line marking conforming to the specifications in Section 5.2.3 shall be provided. Additionally, the location of any temporary threshold shall be identified by a 3.6 m wide transverse stripe.

4.5 The overlay should be constructed and maintained above the minimum friction level specified in 2.3

5. DEVIATIONS

5.1 The Department of Civil Aviation shall notify and publish deviation from any Standards and Recommended Practices contained in ICAO Annex 14 in the Aeronautical Information Services publications in compliance to the Article 38 of the Convention on International Civil Aviation.

5.2 The Appendices to this Directive shall be taken, construed, read and be part of this Directive.

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Director General
Department of Civil Aviation
Malaysia

Dated : 26 April 2016

ATTACHMENT A. GUIDANCE MATERIAL
SUPPLEMENTARY TO ASD 202

1. Runway surface evenness

1.1 In adopting tolerances for runway surface irregularities, the following standard of construction is achievable for short distances of 3 m and conforms to good engineering practice:
Except across the crown of a camber or across drainage channels, the finished surface of the wearing course is to be of such regularity that, when tested with a 3 m straight-edge placed anywhere in any direction on the surface, there is no deviation greater than 3 mm between the bottom of the straight-edge and the surface of the pavement anywhere along the straight-edge.

1.2 Caution should also be exercised when inserting runway lights or drainage grilles in runway surfaces to ensure that adequate smoothness of the surface is maintained.

1.3 The operation of aircraft and differential settlement of surface foundations will eventually lead to increases in surface irregularities. Small deviations in the above tolerances will not seriously hamper aircraft operations. In general, isolated irregularities of the order of 2.5 cm to 3 cm over a 45 m distance are tolerable. Although maximum acceptable deviations vary with the type and speed of an aircraft, the limits of acceptable surface irregularities can be estimated to a reasonable extent. The following table describes maximum and temporarily acceptable limits. If the maximum limits are exceeded, corrective action should be undertaken as soon as reasonably practicable to improve the ride quality. If the temporarily acceptable limits are exceeded, the portions of the runway that exhibit such roughness should have corrective measures taken immediately if aircraft operations are to be continued.

	Minimum acceptable length of irregularity (m)								
Surface irregularity	3	6	9	12	15	20	30	45	60
Maximum surface irregularity height (or depth) (cm)	3	3.5	4	5	5.5	6	6.5	8	10
Temporary acceptable surface irregularity height (or depth) (cm)	3.5	5.5	6.5	7.5	8	9	11	13	15

Note that "surface irregularity" is defined herein to mean isolated surface elevation deviations that do not lie along a uniform slope through any given

section of a runway. For the purposes of this concern, a "section of a runway" is defined herein to mean a segment of a runway throughout which a continuing general uphill, downhill or flat slope is prevalent. The length of this section is generally between 30 and 60 metres, and can be greater, depending on the longitudinal profile and the condition of the pavement.

1.4 Figure A-1 illustrates a comparison of the surface roughness criteria with those developed by the United States Federal Aviation Administration.

1.5 Deformation of the runway with time may also increase the possibility of the formation of water pools. Pools as shallow as approximately 3 mm in depth, particularly if they are located where they are likely to be encountered at high speed by landing aeroplanes, can induce aquaplaning, which can then be sustained on a wet runway by a much shallower depth of water. Improved guidance regarding the significant length and depth of pools relative to aquaplaning is the subject of further research. It is, of course, especially necessary to prevent pools from forming whenever there is a possibility that they might become frozen.

2. Assessing the surface friction characteristics of paved surfaces

2.1 There is an operational need for reliable and uniform information concerning the surface condition of contaminated runways. Contaminant type, distribution and for loose contaminants, depth are assessed for each third of the runway. An indication of surface friction characteristics is helpful in conducting runway condition assessment. It can be obtained by friction measuring devices; however, there is no international consensus on the ability to correlate the results obtained by such equipment directly with aircraft performance.

2.2 The friction conditions of a runway can be assessed in descriptive terms of "estimated surface friction". The estimated surface friction is categorized as good, medium to good, medium, medium to poor, and poor.

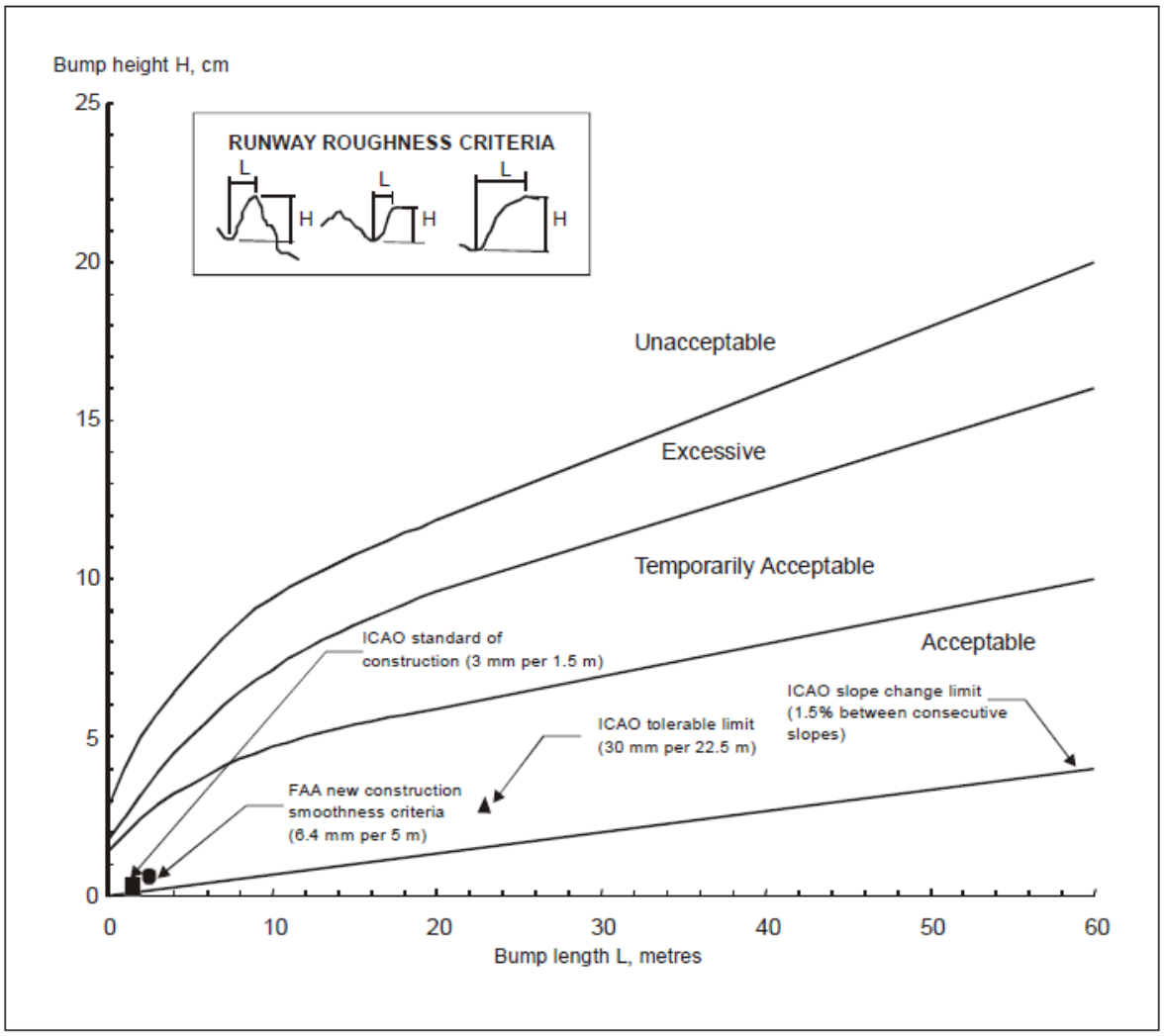

Figure A-1. Comparison of roughness criteria

2.3 Relating braking action to friction measurements has been elusive over the years. The main reason is that the industry to date has not achieved the ability to control the total uncertainty associated with the readings from these devices. Consequently, readings from a friction measuring device should be used only as part of an overall runway condition assessment. A major difference between the decelerometer type of devices and the other types is that when using the decelerometer type the operator is an integrated part of the measuring process. In addition to carrying out the measurement, the operator can feel the behaviour of the vehicle where the decelerometer is installed and by that feel the deceleration process. This gives additional information in the total assessment process.

2.6 It has been found necessary to provide assessed surface condition information, including estimated surface friction, for each third of a runway. The thirds are called A, B and C. For the purpose of reporting information to aeronautical service units, section A is always the section associated with the lower runway designation number. When giving landing information to a pilot before landing, the sections are however referred to as first, second or third part of the runway. The first part always means the first third of the runway as seen in the direction of landing. Assessments are made along two lines parallel to the runway, i.e. along a line on each side of the centre line approximately 3 m, or that distance from the centre line at which most operations take place. The objective of the assessment is to determine the type, depth and coverage of the contaminants and their effect on estimated surface friction, given the prevailing weather conditions for sections A, B and C. In cases where a continuous friction measuring device is used, the mean values are obtained from the friction values recorded for each section. In cases where a spot measuring friction measuring device is used as part of the total assessment of estimated surface friction, each third of the runway should have a minimum of three tests carried out on it where achievable. Information collected and assessed on the state of pavement surface is disseminated using forms prepared for NOTAM (see the Airport Services Manual (Doc 9137) Part 2).

2.7 The Airport Services Manual (Doc 9137), Part 2 provides guidance on the uniform use of test equipment and other information on removal of surface contamination and improvement of friction conditions.

3. Determination of surface friction characteristics for construction and maintenance purposes

The guidance in this section involves the functional measurement of friction-related aspects related to runway construction and maintenance. Excluded from this section is the operational, as opposed to functional, measurement of friction for contaminated runways. However, the devices used for functional measurement could also be used for operational measurement, but in the latter case, the figures given in Airport Services Manual (Doc 9137), Part 2, Table 3-1 are not relevant.

3.1 The surface friction characteristics of a paved runway should be:

a) assessed to verify the surface friction characteristics of new or resurfaced paved runways (ASD301); and

b) assessed periodically in order to determine the slipperiness of paved runways (Clause 2.4).

3.2 The condition of a runway pavement is generally assessed under dry conditions using a self-wetting continuous friction measuring device. Evaluation tests of runway surface friction characteristics are made on clean surfaces of the runway when first constructed or after resurfacing.

3.3 Friction tests of existing surface conditions are taken periodically in order to avoid falling below the minimum friction level. When the friction of any portion of a runway is found to be below this value, then such information is promulgated in a NOTAM specifying which portion of the runway is below the minimum friction level and itslocation on the runway. A corrective maintenance action must be initiated without delay. Friction measurements are taken at time intervals that will ensure the identification of runways in need of maintenance or of special surface treatment before their condition becomes serious. The time intervals and mean frequency of measurements depend on factors such as: aircraft type and frequency of usage, climatic conditions, pavement type, and pavement service and maintenance requirements.

3.4 Friction measurements of existing, new or resurfaced runways are made with a continuous friction measuring device provided with a smooth tread tire. The device should use self-wetting features to allow measurements of the surface friction characteristics to be made at a water depth of 1 mm.

3.5 When it is suspected that the surface friction characteristics of a runway may be reduced because of poor drainage, owing to inadequate slopes or depressions, then an additional measurement is made, but this time under natural conditions representative of a local rain. This measurement differs from the previous one in that water depths in the poorly cleared areas are normally greater in a local rain condition. The measurement results are thus more apt to identify problem areas having low friction values that could induce aquaplaning than the previous test. If circumstances do ot permit measurements to be conducted during natural conditions representative of a rain, then this condition may be simulated. (See section 8.)