



WORKING PAPER

ASSEMBLY — 39TH SESSION

TECHNICAL COMMISSION

Agenda Item 36: Aviation safety and air navigation implementation support

NEED FOR REVIEW OF SUGGESTED LEVEL OF ACTION IN TABLE A 2-2, INSPECTION METHOD FOR VISUAL ESTIMATION OF RUBBER DEPOSITS ACCUMULATED ON RUNWAY, IN THE AIRPORT SERVICES MANUAL (DOC 9137), PART-2

(Presented by India)

EXECUTIVE SUMMARY

Attachment A, section 7 of Annex 14 – *Aerodromes*, Volume I, requires States to specify a minimum friction level below which corrective maintenance action should be taken. It further states, the *Airport Services Manual*, Part 2 — *Pavement Surface Conditions* (Doc 9137) provides guidance on establishing maintenance planning and minimum friction levels for runway surfaces in use. The friction values triggering maintenance planning are not consistent in Table 3-1 (Runway surface condition levels) and Table A 2-2 (Inspection method for visual estimation of rubber deposits accumulated on runway) of Doc 9137. Further, the time period to schedule rubber removal in Table A 2-2 is too liberal and does not relate to number of flight movements. On busy runways, this schedule is unrealistic. Considered review of Table A 2-2 of Doc 9137 by removing discrepancies in suggested level of action to be taken by the airport authority for maintaining requisite friction level of runway will provide more realistic guidance to airport maintenance professionals

Action: The Assembly is invited to instruct the Council to review Table A 2-2 of the *Airport Services Manual*, Part 2 — *Pavement Surface Conditions* (Doc 9137).

<i>Strategic Objectives:</i>	This paper relates to the Safety and Air Navigation Capacity and Efficiency Strategic Objectives.
<i>Financial implications:</i>	Nil
<i>References:</i>	Annex 14 – <i>Aerodromes</i> Doc 9137, <i>Airport Services Manual</i> , Part 2 — <i>Pavement Surface Conditions</i>

1. INTRODUCTION

1.1 Maintaining surface friction characteristics and removal of contaminants from runway surface are dealt in 10.2 and 10.3 of Annex 14 — *Aerodromes* . It suggests that runway surface friction characteristics for maintenance purposes shall be periodically measured with a continuous friction measuring device using self-watering features and documented. The frequency of these measurements shall be sufficient to determine the trend of the surface friction characteristics of the runway.

1.2 It also suggests that contaminants shall be removed from the surface of the runways in use as rapidly and completely as possible to minimize accumulation. 10.2 and 10.3 of Annex 14 refer to the *Airport Services Manual* (Doc 9137), Part 2 — *Pavement Surface Conditions* for further information and guidance.

1.3 Maintenance planning level and minimum friction level, in terms of μ value are given in table 3-1, Runway Surface condition levels of Doc 9137. Table A 2-2 of same document deals with Inspection method for visual estimation of rubber deposits accumulated on runway wherein suggested level of action to be taken by airport authority for similar friction values (μ) do not match with those in Table 3-1. Suggested action in table A 2-2 allows to schedule rubber removal within 60 to 90 days even when estimated friction value (μ) is between 0.39 to 0.20, and without considering Frequency of runway visual inspection surveys, Table A 2-1. On busy runways, rubber removal should not be delayed for two to three months as it may have serious repercussions, particularly in wet conditions.

1.4 The latest edition of Doc 9137, Part-2 published in the year 2002 require amendments, particularly in Table A 2-2.

2. DISCUSSION

2.1 Relevant tables are reproduced below

Table 3-1. 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	B	210	65	1.0	0.69	0.52	0.45

Trailer	B	210	95	1.0	0.63	0.42	0.32
GRIPTESTER	C	140	65	1.0	0.74	0.53	0.43
Trailer	C	140	95	1.0	0.64	0.36	0.24

Table A2-1. Frequency of runway visual inspection surveys

Daily turbo-jet aeroplane arrivals for runway end	Annual aeroplane weight for runway end (million kg)	Minimum friction survey frequency
Less than 15	Less than 447	Once per year
16 to 30	448 to 838	Once every 6 months
31 to 90	839 to 2 404	Once every 3 months
91 to 150	2 405 to 3 969	Once every month
151 to 210	3 970 to 5 535	Once every 2 weeks
Greater than 210	Greater than 5 535	Once every week

Table A2-2. Inspection method for visual estimation of rubber deposits accumulated on runway

Classification of rubber deposit accumulation	Estimated percentage of rubber covering pavement texture in touchdown zone of runway	Description of rubber covering pavement texture in touchdown zone of runway as observed by evaluator	Estimated range of Mu values averaged 150 m segments in touchdown zone	Suggested level of action to be taken by airport authority
Very light	Less than 5%	Intermittent individual tire tracks; 95% of surface texture exposed.	0.65 or greater	None
Light	6-20%	Individual tire tracks begin to overlap; 80-94% of surface texture exposed.	0.55 to 0.64	None
Light to medium	21-40%	Central 6 m traffic area covered; 60-79% of surface texture exposed.	0.50 to 0.54	Monitor deterioration closely
Medium	41-60%	Central 12 m traffic area covered; 40-59% of surface texture exposed.	0.40 to 0.49	Schedule rubber removal within 120 days
Medium to dense	61-80%	Central 15 foot traffic area covered; 30- 69% of rubber vulcanized and bonded to pavement surface; 20-39% of surface texture exposed.	0.30 to 0.39	Schedule rubber removal within 90 days
Dense	81-95%	70-95% of rubber vulcanized and bonded to pavement surface; will be difficult to remove; rubber has glossy or sheen look; 5-19% of surface texture exposed.	0.20 to 0.29	Schedule rubber removal within 60 days
Very dense	96-100%	Rubber completely vulcanized and bonded to surface; will be very difficult to remove; rubber has striations and glossy or sheen look; 0-4% of surface texture exposed.	Less than 0.19	Schedule rubber removal within 30 days or as soon as possible

2.2 As per 3.2.11 of Doc 9137, Table 3.1, is based on experience with different friction measuring criteria in use in some States for specifying the friction characteristics for new or resurfaced runway surfaces, for establishing maintenance planning levels and for setting minimum friction levels. In table 3-1, the *maintenance planning levels* in terms of μ value with test speed 95 km/h varies from 0.36 to 0.54 for different friction measuring devices. Similarly, *minimum friction values* vary from 0.24 to 0.42 under wet condition.

2.3 Appendix 2 of Doc 9137 deals with *procedures for conducting visual inspection runway maintenance surveys at airports that serves Turbo-jet aeroplane operations when friction equipment is not available*. Table A 2-1 suggests the frequency of runway visual inspection surveys with respect to daily turbo-jet aeroplane arrivals for runway end and annual aeroplane weight for runway end. The minimum friction survey frequency for >210 turbo-jet arrivals is once a week while for less than 15 turbo-jet arrivals it is once per year.

2.4 The μ values given in table A 2-2 represent values obtained from continuous friction measuring devices that operate in the fixed braking slip mode. In this table, it is suggested to schedule rubber removal within 120 days for μ values between 0.40- 0.49, within 90 days for μ values between 0.30- 0.39, within 60 days for μ values between 0.20- 0.29 and within 30 days or as soon as possible if μ value is less than 0.19.

2.5 There are following discrepancies when table 3-1 and table A 2-2 are compared:

- a) the minimum μ value that triggers maintenance planning in table 3-1 is 0.36 and minimum friction level is 0.24 whereas in table A 2-2, for friction level of 0.36, scheduling of rubber removal is suggested within 90 days and for friction level of 0.24, it is 60 days. Since friction level (μ values) in both the tables is from continuous friction measuring devices, the suggested action should be similar;
- b) suggested level of action in table A 2-2 allows scheduling rubber removal even up to 120 days of observation but does not consider number of turbo-jet arrivals. In busy airports with high number of turbo-jet movements, this time limit may not be appropriate. Since the visual inspection frequency varies from once every week to once in a year as per table A 2-1, the suggested action should be commensurate to table 3-1:
 - 1) plan maintenance/ rubber removal (when friction level is between 0.54- 0.36); and
 - 2) remove rubber immediately or as soon as possible (when friction level is below 0.36).

2.6 Proposed modified contents of Table A 2-2 are given below:

Classification of rubber deposit accumulation	Estimated percentage of rubber covering pavement texture in touchdown zone of runway	Description of rubber covering pavement texture in touchdown zone of runway as observed by evaluator	Estimated range of μ values averaged 150 m segments in touchdown zone	Suggested level of action to be taken by airport authority
Very light	Less than 5%	Intermittent individual tire tracks; 95% of surface texture exposed	0.65 or greater	None
Light	6-20%	Individual tire tracks begin to overlap; 80-94% of surface texture exposed	0.55 to 0.64	Plan Maintenance/ rubber removal

Light to medium	21-40%	Central 6 m traffic area covered; 60-79% of surface texture exposed	0.50 to 0.54	Plan Maintenance/ rubber removal
Medium	41-60%	Central 12m traffic area covered; 40-59% of surface texture exposed	0.40 to 0.49	Plan Maintenance/ rubber removal
Medium to dense	61-80%	Central 15 foot traffic area covered; 30-69% of rubber vulcanized and bonded to pavement surface; 20-39% of surface texture exposed	0.30 to 0.39	Remove rubber immediately or as soon as possible
Dense	81-95%	70-95% of rubber vulcanized and bonded to pavement surface; will be difficult to remove; rubber has glossy or sheen look; 5-19% of surface texture exposed	0.20 to 0.29	Remove rubber immediately or as soon as possible
Very dense	96-100%	Rubber completely vulcanized and bonded to surface; will be very difficult to remove; rubber has striations and glossy or sheen look; 0-4% of surface texture exposed.	Less than 0.19	Remove rubber immediately or as soon as possible

Note: With respect to rubber accumulation, there are other factors to be considered by the airport operator: the type and age of the pavement, annual climatic conditions, time of year, number of wide-body aeroplanes that operate on the runways and length of runways. Accordingly, the recommended level of action may vary according to conditions encountered at the airport. The Mu ranges shown in the above table are from continuous friction-measuring devices that operate in the fixed braking slip mode. The Mu ranges are approximate and are to be used by the airport operator only when these devices are not available. When the devices are available, the airport operator should conduct friction surveys on the runways to establish the actual rubber classification level.