RC 421.02

SKID RESISTANCE OF A ROAD PAVEMENT USING SCRIM

1. SCOPE

This test method details the measurement of the skid resistance of a road pavement surface using a Sideways force Coefficient Routine Investigation Machine (SCRIM).

2. DEFINITIONS

2.1 SCRIM (Sideways-force Coefficient Routine Investigation Machine)—a self contained machine for the measurement of skid resistance under wet road conditions. It is capable of maintaining a constant test speed and measuring both wheel paths independently.

2.2 SCRIM Reading (*SR*)—the ratio of the sideways force to the vertical reaction on the SCRIM test wheel recorded as an individual measurement for a single sub-section of pavement surface 5 metres long. It is expressed as a positive, unsigned integer, unadjusted for speed or temperature.

2.3 SCRIM Coefficient (*SC*)—a SCRIM Reading adjusted after any relevant corrections for load, speed and temperature.

2.4 Sideways Force Coefficient (*sfc*)—the SCRIM Coefficient identified with a subscript designating the test speed is shown, e.g. sfc_{50}

2.5 Differential Friction Level (*DFL*)—100 times the difference between the SCRIM Coefficient value obtained for each wheel path at the same chainage.

2.6 Section Sideways Force Coefficient ($Ssfc_m$)—the calculated minimum section skid resistance levels for each wheel path over 100 m.

2.7 Investigatory Level (IL)—level of skid resistance at or below which and/or the differential friction level above which a site investigation is to be undertaken (see table 2).

3. APPARATUS

The following apparatus is required:

(a) A SCRIM capable of travelling at constant speeds of 20 km/hr and 50 km/hr and fitted with:

(i) a water tank which is capable of discharging water onto road surface immediately in front of the test wheel at a rate of 60 L/min during the test;

(ii) two freely rotating test wheels with axis centred in the normal traffic wheel paths and the distance between the line of loading of the wheels known to within ±0.1 m. The wheels shall be fitted with standard test tyres (3.00 x 20, manufactured by the Avon Tyre Company, England) operated at a tyre pressure of 350 ±20 kPa (when tested cool), inclined 20 ±0.5° (toe-in angle) to the direction of travel to which a vertical load of 2 kN ±10 N is applied;

(iii) a load cell attached to each wheel to measure the sideways force shall be capable of measuring loads of up to 3 kN to the nearest ±0.5 N;

(iv) a device for measuring speed of travel of the vehicle to within ± 1 km/hr;

(v) a device for measuring the distance travelled to within ± 1 m/km;

(vi) a data acquisition system which is capable of capturing SCRIM readings, forward speed, ambient temperature and distance measurements every 5 m of travel.

(b) Water free from foam, oil scum and other materials which may affect the measurement.

(c) A device for measuring the tyre pressure to within ±10kPa.

(d) Temperature measuring device capable of measuring ambient temperature to within ±1°C.

(e) Load cells and displays for use in checking the vertical load and for the static calibration of the sideways force on the test wheel.

4. PROCEDURE

4.1 Daily checks

(a) Prior to commencement of operations on each day, check that the tyre pressure in the standard test tyres

when cold is 350 ±20 kPa. Check the tyres for damage and wear.

Note: A test tyre shall be discarded when the loss in diameter of the tyre exceeds 12 mm or when otherwise damaged.

(b) Check that there is sufficient water in the tank to provide water to the surface for each test run.

(c) After warming up the SCRIM measuring and data acquisition systems or immediately after completion of a days testing, check that the sideways loads on the wheel by comparing the digital readout from the data acquisition system and the load as measured by the load cell. If any variation to the output reading is required, record this adjustment as C_a.

(d) When new tyres are placed on the measuring wheels the tyres shall be conditioned by running them as detailed in the measurement procedure for 1 km.

4.2 Measurement

(a) Turn on the water to ensure that water is flowing under the test tyre, lower the test wheel and apply the 3 kN load.

(b) Operate the SCRIM to travel at a notional speed nominated in Table 2 dependent on the Site Category. The test tyres shall be located in the wheel paths required for test. Due to variations in traffic conditions, it is permissible to operate at speeds shown in Table 1 provided the corrections shown are applied to the readings. Corrections outside 16-24 km/hr are not permitted when testing Site Category 6 or 7. When speeds fall outside the limits shown, the results should be flagged as unsuitable for analysis.

TABLE 1 CORRECTION TO SCRIM READINGS

Speed (km/hr) (Site Categories 1 to 5)	Correction to SCRIM Reading (SR)
67-65	+3
64-60	+2
59-55	+1
54-46	0
45-42	-1
41-38	-2
37-34	-3
33-30	-4

(c) Set the data acquisition system to obtain the following readings for each test wheel every 5 m:

(i) SR (SCRIM Reading) (see definitions and calculations)
(ii) Odometer reading
(iii) Test speed
(iv) Ambient temperature.

(d) At each test site, record the site category related to the site description detailed in Table 2. As necessary during each test run, record any change in road surface, conditions and features.

(e) For each section or run, record

(i) weather conditions, including previous rainfall
(ii) date
(iii) surface type
(iv) lane tested
(v) start and end distances of run and reference points.

5. CALCULATIONS

5.1 At each test site:

Calculate:

(a) SCRIM Reading (*SR*) using the following equation:

$$SR = \frac{\text{Sideways Reaction}}{\text{Vertical Reaction}} * 100$$

where
Sideways reaction is the horizontal force measured on the wheel, in N

Vertical reaction is the vertical load on the surface (2 kN ± 10 N)

(b) The adjusted SCRIM (SR_a) reading due to load checks in Clause 4.1(c) using the following equation:

$$SR_a = SR + C_a$$

where
SR is the SCRIM Reading
C_a is the adjustment to output readings determined in Step 4.1(c).

(c) The speed corrected SCRIM reading (SR_s) using the following equation:

$$SR_s = SR_a + S_c$$

where
SR_a is the adjusted SCRIM reading due to load checks
S_c is the speed correction for actual speed determined from Table 1.

(d) The temperature corrected SCRIM reading (SR_t) due to temperature from the following equation:

$$SR_t = SR_s + 0.3\,(T - 20)$$

where
T is the ambient temperature, in°C

(e) The SCRIM Coefficient (SC) after correction for load, speed and temperature from the following equation:

$SC = SR_t/100$

(f) Sideways Force Coefficient specifying the speed using the following equation:

$sfc_m = SC$

where
sfc_m is the test speed at *m* km/hr to which readings were adjusted in Step (c).

(g) The differential friction level (*DFL*).

5.2 When required, for each 100 m section:

(a) Calculate the mean of a four point rolling average on all data (left and right wheel paths separately) by replacing the value for a point (site) by the mean value of that point, the two previous points and the next point.

(b) Calculate the section skid resistance (*$Ssfc_m$*) by determining the minimum value of all data points for both wheelpaths (40 points) of the values determined in Step 5.1(f).

(c) Determine the section differential friction level by identifying the maximum difference between adjoining adjusted *sfc_m* readings over the 100 m section.

6. TEST REPORT

Report the following:

6.1 For each site

(a) The sideways force coefficient (*sfc_m*) to the nearest 0.1.

(b) The site location.

6.2 For each test run

(a) The weather conditions including previous rainfall in the last 5 days.

(b) Date.

(c) Surface type.

(d) Lane(s) tested.

(e) Start and end distances of run and reference points.

6.3 When required, for each section

(a) The section skid resistance (*$Ssfc_m$*) to the nearest 0.01.

(b) The maximum differential friction level to the nearest 1.0.

(c) The investigatory level for skid resistance and maximum differential friction levels as determined from Table 2.

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Table 2
Investigatory Skid Resistance Levels

Site Category	Site Description	Investigatory Levels of sfc_{50} (at 50 km/hr or equivalent)						
		0.30	0.35	0.40	0.45	0.50	0.55	0.60
		CORRESPONDING RISK RATING						
		1	2	3	4	5	6	7
1#	Traffic light controlled intersections Pedestrian/crossings Railway level crossings Roundabout approaches	INVESTIGATION ADVISED						
2	Curves with radius =< 250 m Gradient => 5% and => 50 m long Freeway/highway on/off ramps							
3#	Intersections							
4	Manoeuvre-free areas of undivided road							
5	Manoeuvre-free areas of divided roads							

Site Category	Site Description	Investigatory Levels of sfc_{20} (at 20 km/hr or equivalent)						
		0.30	0.35	0.40	0.45	0.50	0.55	0.60
		CORRESPONDING RISK RATING						
		1	2	3	4	5	6	7
6	Curves with radius =< 100 m	INVESTIGATION ADVISED						
7	Roundabouts							

Investigatory Levels for site categories 1 and 3 are based on the minimum of the four-point rolling average skid resistance for the section from 50 m before to 20 m past the feature, or for 50 m approaching a roundabout.

KEY TO THRESHOLDS AT OR BELOW WHICH INVESTIGATION IS ADVISED

all primary roads, and for secondary roads with more than 2500 vehicles per lane per day

roads with less than 2500 vehicles per lane per day

Notes:

(a) The Differential Friction Levels should be less than 10 where the speed limit is over 60 km/hr; or less than 20 where the speed limit is 60 km/hr or less.

(b) Investigatory Levels are based on the minimum of the four-point rolling average skid resistance for each 100 m length.