

## Assessment of Damage by Use of the Viewing Box

## 1 Scope

Although first developed as a method for assessing scuff damage, this method may be useful in assessing surface damage produced in other ways as well. Scuff damage to a leather may be produced by the use of an article made from it, or by applying to the leather a test designed to test its resistance to scuffing. The present method can be used to assess both types of damage and can be used with any leather.

## 2 Specimen

The specimen consists of a piece of leather containing both a scuffed and an unscuffed area which can be compared with one another. Unless otherwise specified, the specimen is conditioned before test in accordance with the method of conditioning given in SLP 3 (see 7.1).

## 3 Principle of the method

The method does not attempt to measure the scuff damage by assessing the amount of mechanical damage (tearing, roughening of the surface, and so on), but the extent to which the damage is obvious to the human eye. The damage is classified as bad if it is easily seen (see 7.2). Because the assessment of some kinds of scuff damage depends upon the directions from which light reaches the specimen, two separate assessments are made with different lighting arrangements. One of these assessments emphasises damage which results in colour changes and the other emphasises damage in the form of roughening of the scuffed surface (see 7.3).

A standard scuff scale consists of a series of circular spots of different sizes and having different densities with a dark grey background. A score is allotted to each spot of the scale. The scale is viewed simultaneously with the scuff damage of the specimen and the illumination is gradually reduced until the scuff damage disappears; the score of the scuff damage is that corresponding to the least bright of the spots just visible at this illumination (see 7.4).

## 4 The scuff scale

The scale consists of a photograph, copies of which can be purchased (see 7.5). It has a ring of circular spots on a dark grey background (see Fig 1). The ring is of diameter about 47 mm and the diameters of the spots increase in geometric progression from 1.45 mm to 4.95 mm. The spots have different reflection densities, and are allocated scores ranging from unity (smallest contrast with the background) up to 10 (greatest contrast). When the spots are viewed in a mirror, their positions correspond to those of the same numbers on a clock face. A circular area of diameter 25 mm is cut away at the middle of the ring of spots and the specimen is viewed through this (see 7.6).

The reflection density  $B$  of the background is approximately 1.20, and the

reflection density  $S$  of the spot numbered  $n$  is given approximately by the formula:

$$1 + \log_{10}(B - S) = 0.048 + 0.0582n + 0.00280n^2$$

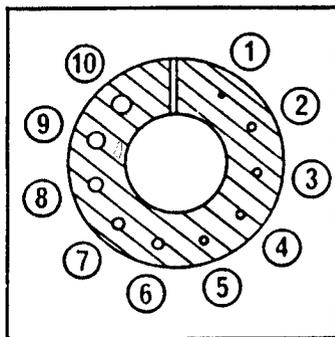


Fig 1 Scuff scale

## 5 The viewing box

The box (Fig 2) consists of two parts, both of which are of square section with sides (internal) 230 mm. The upper part A has a height (internal) of 300 mm and is enclosed at the top. It can be lifted off and used separately from the bottom part B, which has a bottom but no top. Each part has a hinged door C through which the specimen and scale can be introduced.

When the top part only is used, it stands on a white card as base and the interior of the box is illuminated by an ordinary 25 watt tungsten filament lamp D with a pearl bulb, mounted at the middle of the top. When both parts of the box are in use together, the 25 watt lamp is replaced by one of 60 watts. To facilitate changing the lamps, the part of the top to which the lamp holder is attached can be lifted off. To prevent overheating, there are two holes of 25 mm diameter in the top of the box; their centres are 25 mm from the mid-points of opposite sides of the box. A thin brass plate E, of 89 mm diameter, is suspended directly below the lamp, and its upper face is 150 mm below the removable part of the top of the box. The upper face of E and the internal walls and top of the part A are painted white and have a luminance exceeding 80%. The internal walls and floor of part B are matt black and have a luminance less than 10% (see 7.7).

A clean, plane, square mirror F, of length and breadth 100 mm, is supported on thin rods directly below D and E. The mirror makes an angle of  $45^\circ$  with the vertical and its upper and lower sides are horizontal. Its mid-point is 190 mm below the removable part of the top of the box. The specimen and scale are placed at the middle of the bottom of B or A (according as B and A are being used together, or A is being used alone) and are viewed through the tube G by light reflected from the mirror. The tube G has an internal diameter of at least 37 mm and the other dimensions as in Fig 3. It contains a stop H with aperture 25 mm and another at G of aperture 8 mm diameter. It has an eye shield J and a pair of plates which form a slit normal to the axis of the tube. Through this slit can be passed a strip of film called a step tablet



specular reflection is more important and the two parts A and B of the box are used together as shown in Fig 2. The specimen and scale are placed at the middle of the floor B, but otherwise as described above.

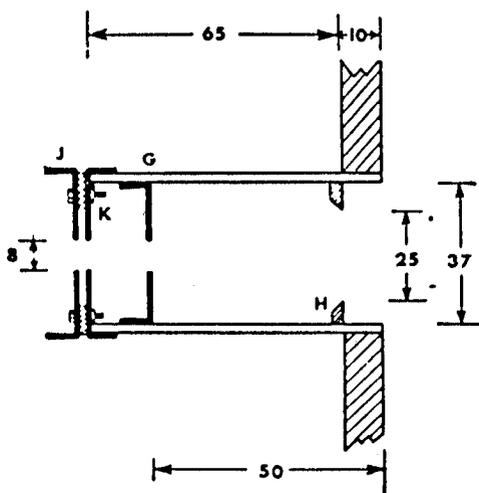


Fig 3 Eyepiece of the viewing box (dimensions in millimetres)

In making the assessments, the illumination reaching the eye is reduced in steps by sliding a Kodak 'photographic step tablet' No 3 in the slot between the plates K (Fig 3). The step tablet consists of a strip of photographic film, 250 mm by 22 mm, having 21 steps of photographic density along its length (see 7.8 and 7.9).

## 6 Procedure

6.1 Remove part B of the viewing box. Place part A on the square of white card which forms its base. Place the specimen on the card with its scuffed area near the middle of the card. If the scuff damage has been produced in a scuff test and not by actual wear, turn the specimen so that its longer sides appear vertical when viewed in the mirror (see 7.10). Place the scuff scale on the specimen so that the scuffed area can be seen near the middle of the scale and so that the white line marking 12 o'clock on the scale appears uppermost in the mirror. Close the door of the box to exclude light from the room (see 7.11). Make a preliminary estimate of the scuff score by moving the step tablet until the scuff damage just disappears and noting the least bright spot of the scuff scale then visible. Move the step tablet until the scuff damage can again be seen.

6.2 While observing the scuffed area, reduce the intensity of the light reaching the eye by movement of the step tablet until the scuffed area is no longer visible against its background. Immediately note the score of the least bright spot of the scuff scale which remains visible at this illumination, and allot this score to the scuff damage

(see 7.12 and 7.13). The score so obtained is called, for brevity, the 'scuff score by colour change', even although changes other than those of colour help to make the damage visible.

- 6.3 Place the two parts of the viewing box together as in Fig 2. Place the specimen at the middle of the bottom B and the scuff scale on the specimen; adjust their positions otherwise as in 6.1 and close the door of the box.
- 6.4 Assess the scuff damage in the manner described in 6.2. The score so obtained by using the two parts of the box together is called for brevity the 'scuff score by roughening', although colour changes can greatly influence this assessment (see 7.14).
- 6.5 Report the scuff score by colour change and the scuff score by roughening.

## 7 Notes

- 7.1 If a specimen has been subjected to a scuffing test while wet, it is usually less important to assess the damage of the wet specimen than to assess it after it has been dried again, but assessments of wet specimens are sometimes useful. If the assessments are made while the specimen is wet, this must be stated when the report is made.
- 7.2 Damage to a dark leather with a dark finish is often less obvious than a similar amount of mechanical damage on a light leather with a dark finish, whether the damage occurs in practical use or by application of a scuff test. For this reason, scuff tests and their associated scuff scores measure the properties of the combination leather-plus-finish and not those of the finish or leather separately. Because of this, two finishes can only be compared if they are applied to the same leather and the comparison so made may not be valid for the same finishes on a different kind of leather.
- 7.3 The two assessments on the same leather frequently differ considerably, so both assessments must be made on each specimen.
- 7.4 In experimental work done near the illumination corresponding to the threshold of vision, anomalous results are sometimes obtained, but no difficulties have been encountered when the assessment is made exactly as described in Section 6.
- 7.5 Copies of the negative from which the scuff scales are printed are held by the Editorial Office of the Society of Leather Technologists and Chemists, The British Leather Confederation and Satra. The viewing box and scuff scale can be purchased from Satra, Satra House, Rockingham Road, Kettering, Northamptonshire, England.
- 7.6 Spots of different sizes are used in the scuff scale because the assessments of scuff damage are then less dependent upon the acuity of vision and resolving powers of the observers.

- 7.7 The interior walls of A may be painted with a matt white paint or covered with clean white cardboard. The interior walls and floor of B may be painted with any matt black paint.
- 7.8 Photographic step tablet No 3 has 21 steps of photographic density ranging from 0.05 to 3.05 approximately. It can be obtained from Kodak Ltd, Kingsway, London WC2. To prevent it becoming scratched it should be mounted between a pair of glass plates. Step tablets mounted in this way can be obtained from Satra.
- 7.9 The design of the viewing box prevents light from travelling directly from the lamp to the step tablet and being scattered from the step tablet to the eye.
- 7.10 The assessments of some specimens differ slightly according to their direction in the box, but not enough to make it worthwhile repeating the assessments in various directions.
- 7.11 It is an advantage to work in a room with a low illumination (below 5 ft candles) because there is less likelihood of light from the room being scattered at the step tablet; also because the sensitivity of the eye is reduced by strong illumination and recovery of sensitivity needs longer when the observer moves back to the box.
- 7.12 Although the illumination can be reduced slowly while the observer is causing the scuff damage to disappear, he must assess the score immediately when this stage is reached; otherwise spots on the scuff scale which were invisible are likely to appear one after the other as the eye becomes better adapted to low illumination. The preliminary estimation of the scuff score informs the observer of the part of the scale to which he should direct his attention and hence permits the final decision to be made rapidly.
- 7.13 Although the results of assessments are not very dependent on the observer's acuity of vision, he must be able to focus clearly on objects at the distance of the specimen. An observer who habitually wears spectacles may find it convenient to use instead a lens mounted in the tube G (Fig 3) close to K. It is believed that observers whose eyes have moderate colour anomalies are likely to obtain assessments not very different from those of normal observers; nevertheless, only observers whose vision is approximately normal should make assessments.
- 7.14 If scuff damage causes a pronounced colour change, it will be obvious in both assessments and will also be obvious in all practical conditions, irrespective of the way the leather is viewed. If there is little or no colour change, the first assessment will give a low score (little damage), but the second will depend on the extent of roughening and rucking up of the surface; the same scuff damage will receive two different assessments in practical conditions according to the ways it is illuminated and viewed.