



IAAF Certification System

Track Synthetic Surface Testing Specifications

IAAF TRACK SYNTHETIC SURFACE TESTING SPECIFICATIONS

1. GENERAL

This document has been produced to assist IAAF-accredited laboratories in their assessment of athletics facilities using the test procedures laid down below by the IAAF. These Specifications supersede the “Performance Specifications for Synthetic Surfaced Athletics Tracks (Outdoor)” and the “Track Facilities Testing Protocols”.

The IAAF has laid down precisely what its requirements are for the various parameters to be measured and assessed. However, the detailed testing methodology and its application to a completed athletics facility have been the subject of on-going discussion between the laboratories for some time. The consensus is that the “Guidance Notes on Proposed Test Procedures for IAAF Approved Test Laboratories” dated March 1990 need to be further updated and more detailed to ensure a proper uniformity of approach between the various accredited laboratories. This document is therefore an attempt to minimise the potential for discrepancies.

When testing and assessing an athletics facility, the production of mere “numbers” for each procedure applied to the surface at different locations is generally insufficient to form a proper judgement of the adequacy of the surface for athletics. This is why the IAAF has accredited a network of laboratories around the world with the requisite experience and expertise to “interpret” the results and observations made on site correctly. This experience and expertise helps to protect the interests of all the parties involved, including the manufacturer of the synthetic surfacing system, the installer, the main contractor, the designer, the owner and the athletes who will use the facility.

The procedures set out below are considered adequate for a facility in generally good condition. Where the synthetic surface is showing evidence of problems, it may be necessary to extend the testing to other areas, to increase the frequency of tests, or to apply additional techniques to identify and quantify particular problems. These are matters best left to the professional judgement of the IAAF-accredited test laboratory.

Any final decision on the approval of a facility rests entirely with the IAAF.

2. INSPECTION AND TESTING PROCEDURES

2.0 General

The equipment and test procedures to be used by the testing laboratory are shown in the current edition of the IAAF Track & Field Facilities Manual.

The calibration of all equipment, the training of all personnel etc. shall be in accordance with ISO 17025.

2.1 Imperfections

Requirements

The durability and dynamic performance of the surface may be compromised by imperfections such as bubbles, fissures, delamination, uncured areas etc. These will not be allowed and must be corrected.

Method

A careful visual examination of the entire surface is conducted and the positions and extent of any imperfections are noted on a plan of the facility. A photographic record of imperfections may be used to enhance the report.

Note: in some cases uncured areas may not be identified until the thickness survey is undertaken (see 2.3). For instance uncured material might only be detected for the first time when a thickness probe is withdrawn from the surface and is found to be smeared with sticky resin. This may happen with multi-layer systems where one or more of the lower layers is uncured but the upper layer appears sound. It is important that the extent of any area of uncured material is fully identified.

2.2 Evenness

Requirements

The surface shall be installed so that on a localized level, there shall be no high spots or depressions beneath a 4m straightedge exceeding 6mm. Depressions beneath a 1m straightedge shall not exceed 3mm. There shall be no step-like irregularities greater than 1mm in height. Particular attention is to be paid to seams and joints in the surface. The intent is to ensure the safety of the athlete and provide an even running surface.

Method

Place the 4m straightedge on the surface over lanes 1-3 at 90° to the kerb and drag it around the entire circuit. Move it out to the next three lanes and repeat the drag around the entire circuit. For circuits with more than 6 lanes, continue until all lanes have been dragged. Turn the straightedge through 90°, place on the surface in lane 1 (parallel to the kerb) and drag it to the outer kerb. Move it along 4m and drag it back to the inner

kerb. Move it along 4m and drag it back to the outer kerb. Repeat until the entire circuit has been dragged.

On runways, place the 4m straightedge on the surface parallel to the kerbs and in the centre of the runway and drag it from one end to the other.

On fan areas, drag the 4m straightedge across its width, move it along 4m and repeat the drag back across its width. Repeat again until the full width of the fan has been dragged. Repeat the entire process along its length.

Use continual visual observation to determine if a gap exists under the straightedge. Should a gap exist, verify that both ends of the straightedge rest on the surface, moving the straightedge if necessary, then use a calibrated wedge to determine the actual size of the gap.

The intention is that the entire area of surface should be dragged with the 4m straightedge. Placing the straightedge on a regular 'grid' of individual locations is not an appropriate method for assessing the entire surface.

Whenever, during the 4m straightedge survey, a step-like or other irregularity is visually identified which gives a wedge reading below the maximum permitted, but which is considered to be likely to give a wedge reading above the 1m straightedge maximum, the 1m straightedge should be placed across the irregularity and its exact height measured using the calibrated wedge.

Any location where a gap is found exceeding the maximum permitted, is recorded on a plan of the facility. The record should also identify whether the deviation is a high spot or a depression.

Note: sometimes in moving the straightedge slightly to find the maximum gap, it becomes clear that the irregularity is a high spot rather than a depression. In order to find the magnitude of the high spot, place the centre point of the 4m straightedge on the high spot and rotate the straightedge through 360° until the maximum gap is obtained under one end of the straightedge by pressing the other end down against the surface. Measure the gap beneath the elevated end of the straightedge and then divide this figure by two to give the magnitude of the high spot.

The methodology above has been demonstrated to be adequate for most facilities but alternative test methods may be accepted by the IAAF provided the test methods can be shown to be at least as effective in identifying and quantifying all unacceptable surface deviations. If an alternative test method is used then it shall be fully explained in the report.

2.3 Thickness

Requirements

The durability of the surface and the safety of the athlete can be affected by the thickness of the surface. The use of spikes enhances this requirement for a minimum thickness. There will be specifically designed areas such as in the javelin runway or

other high stress areas where the safety of the athlete and the durability of the surface will dictate that the thickness be greater than the minimum. This additional thickness shall not affect the flatness of the surface.

The thickness of the surface shall be determined to meet force reduction and vertical deformation requirements hereunder. The IAAF Product Certificate for a synthetic surface material indicates the absolute thickness at which a sample of the material, tested in a laboratory, complied with these Testing Protocols. The overall thickness laid will probably have to be greater to ensure that no in-situ test result will fail. The total area over which the absolute thickness falls more than 10% below the absolute thickness given in the IAAF Product Certificate for the material used shall not exceed 10% of the total surface area. The high stress areas with a deliberately thickened surface shall not be taken into account in computing these percentages.

Note that force reduction and vertical deformation performance requirements take precedence over the thickness requirements.

The absolute thickness shall not be determined to the top of the surface crumb or texture but by the method explained later in this section.

Method

A calibrated 3-prong depth-measuring probe in accordance with EN 1969 Floor-Test FT3 method is used to determine the overall thickness of the surface. Care must be taken not to penetrate the asphalt or bitumen-macadam base beneath the surface. The thickness is measured by starting at the finish line and taking sets of readings at 10m intervals around the circuit. The first set of readings is to be taken in the even lanes (2, 4, 6, 8) and the next set in the odd lanes (1, 3, 5, 7), alternating between even and odd lanes every 10m around the circuit. Readings shall be taken in the centre of each lane. At the 110m start position on each straight, readings shall be taken in the centre of each lane. Runways including the steeplechase lane on the circuit shall be probed at 5m intervals centred along the length. The fan areas shall be probed at 5m intervals along parallel axes in two directions.

Where exceptionally thin areas are detected, additional probe readings shall be taken in all directions until an acceptable thickness is measured. An exceptionally thin section is defined as where the absolute thickness is less than 80% of the Product Certificate absolute thickness. The laboratory shall determine, depending on the extent of the exceptionally thin area, its location and the minimum thickness measured, whether to recommend that the area be cut out and reinstated to greater thickness. Additionally, the exact extent of over-thickness (reinforced) areas shall be determined by probe readings in the same way as above. All measurements taken are recorded (but see next paragraph) and the test points listed in the test report.

At a number of locations in the laid surface a core (15mm to 25mm in diameter) is removed and measured using the following method to make the final determination as to the absolute thickness. At least four cores shall be removed, but more than this number are required if the surface is thin over large areas. All core holes to be repaired immediately. The surface texture of the core is abraded with a grade 60 abrasive for approximately 50% of the surface area of the core. The thickness of the abraded area of

the core is measured using a thickness gauge fitted with a 0.01mm accuracy dial, a plunger with a flat measuring surface of 4mm diameter and with a measurement force between 0.8N and 1.0N. The measurement is recorded to the nearest 0.1mm.

The difference in thickness between the actual surface and the abraded surface is calculated and the difference deducted from all of the actual probe measurements. These amended figures are recorded as the absolute thickness of the surface for the purpose of the report.

2.4 Force Reduction

Requirements

The dynamic interaction between the athlete and the surface is significant to the performance and safety of the athlete. Therefore the ability of the surface to reduce force (absorb energy) is important. The force reduction shall be between 35% and 50%, at any surface temperature between 10°C and 40°C. If, at the time of measurement, the temperature of the surface is outside this range, it shall be permissible for the results obtained to be corrected for temperature, by interpolation from a graph of force reduction against temperature for the precise surfacing system installed, previously obtained by laboratory testing.

Laboratory tests for product certificates shall be undertaken on samples at a minimum of six approximately equally spaced temperatures over the range 0°C to 50°C plus a seventh temperature of 23°C. Since this series of tests are intended to establish the extent to which the results are affected by temperature, it is important that at each temperature, an area of surface of the same thickness is tested, so that any variation in results due only to thickness can be avoided. It shall be noted for the Manufacturer's and the IAAF's information those temperatures where it is possible that an in-situ test might fail due either to temperature effects and/or lesser or greater thickness of synthetic surface due to imperfections in the asphaltic concrete surface under the synthetic surface.

If no graph is available then testing outside the surface temperature range shall not be undertaken.

Because of the fact that it is usual to install greater thicknesses of synthetic surface at take-off areas and at the ends of runways, it is possible that results obtained in these areas may fall outside the above range.

Method

A full description of the apparatus and details of the method are given in EN 14808:2005, except that the low-pass filter shall have a 9th order Butterworth characteristic.

The 95% confidence limits of this method are calculated at plus or minus 1%.

At least one measurement shall be made for every 500m² of normal thickness synthetic surface, with a minimum of twelve (12) measurements over the facility. The test positions shall be as follows:

1. At the discretion[#] of the test laboratory in any lane around the first radius*
2. In the centre of lane 2 at the 130m mark on the back straight
3. In the centre of lane 5 at the 160m mark on the back straight
4. At the position of lowest thickness on the back straight*
5. At the discretion[#] of the test laboratory in any lane around the final radius*
6. In the centre of lane 1 at the 320m mark on the main straight
7. In the centre of lane 4 at the 350m mark on the main straight
8. In the centre of the outer lane at the 390m mark on the main straight
9. At the position of lowest thickness on the main straight*
10. At the discretion[#] of the test laboratory at any position (except the high-jump take-off point) over the semi circular area. Where there are two semi circular areas, a test shall be performed on each of them.
11. At the discretion[#] of the test laboratory at any position (except the reinforced areas) on each of the runways (long jump/triple jump, pole vault, javelin) and in the steeplechase lane.

[#]Whenever the selection of the test location is left at the discretion of the laboratory, that location must be close to the average thickness of the track as a whole.

*For the purposes of testing, the first radius is defined as 10m to 100m, the back straight as 110m to 200m, the final radius as 210m to 300m, and the main straight as 310m to 400m.

If the area of synthetic surface is exceptionally large (for example 10 or 12 lane straights), any necessary additional tests shall be done at locations selected by the test laboratory.

At each location, the temperature of the surface shall be measured with a needle temperature probe and recorded. Each test position shall be recorded on a plan of the facility with the results recorded in the report.

Note: if the surface temperature is outside the permitted range of 10°C to 40°C, temperature correction of the results may be employed on the basis of interpolation from laboratory results as described in the first paragraph. However, it is sometimes possible to avoid the need for this, by conducting the testing at a different time of day. For instance, if the facility is in a hot region, testing early in the morning or in the evening can result in the surface temperature falling to within the above range.

2.5 Vertical Deformation

Requirements

The dynamic interaction between the athlete and the surface is significant to the performance and safety of the athlete. Therefore the ability of the surface to deform

under load is important. Too high a deformation can affect the safety of the athlete through instability of the foot, while the inability of the surface to deform can cause injuries due to impact forces. The vertical deformation shall be between 0.6mm and 2.5mm, at any surface temperature between 10°C and 40°C. If, at the time of measurement, the temperature of the surface is outside this range, it shall be permissible for the results obtained to be corrected for temperature, by interpolation from a graph of vertical deformation against temperature for the precise surfacing system installed, previously obtained by laboratory testing.

Laboratory tests for product certificates shall be undertaken on samples at a minimum of six approximately equally spaced temperatures over the range 0°C to 50°C plus a seventh temperature of 23°C. Since this series of tests are intended to establish the extent to which the results are affected by temperature, it is important that at each temperature, an area of surface of the same thickness is tested, so that any variation in results due only to thickness can be avoided. It shall be noted for the Manufacturer's and the IAAF's information those temperatures where it is possible that an in-situ test might fail due either to temperature effects and/or lesser or greater thickness of synthetic surface due to imperfections in the asphaltic concrete surface under the synthetic surface.

Method

A full description of the apparatus and details of the method are given in EN 14809: 2005

The 95% confidence limits of this method are calculated at plus or minus 0.1mm.

At least one measurement shall be made for every 500m² of normal thickness synthetic surface, with a minimum of twelve measurements for the facility. Test locations shall be the same as listed in Section 2.4 Force Reduction.

If the area of synthetic surface is exceptionally large (for example 10 or 12 lane straights), any necessary additional tests shall be done at locations selected by the test laboratory.

At each location, the temperature of the surface shall be measured with a needle temperature probe and recorded. Each test position shall be recorded on a facility plan with the results recorded in the test documentation.

Note: If the surface temperature is outside the permitted range of 10°C to 40°C, temperature correction of the results may be employed on the basis of interpolation from laboratory results as described in the first paragraph. If no graph is available then testing outside the surface temperature range shall not be undertaken. However, it is sometimes possible to avoid the need for this, by conducting the testing at a different time of day. For instance, if the facility is in a hot region, testing early in the morning or in the evening can result in the surface temperature falling to within the above range.

2.6 Friction

Requirements

The safety of the athlete can be adversely affected by slippage between the foot and the surface in a wet or dry condition. Generally friction is achieved through the application of texture to the surface, however the type of footwear will be a factor. In order to identify the influence of the surface, a standard foot is utilised in the methods employed here for measuring friction. The coefficient of dynamic friction shall be not less than 0.5 under wet conditions. Since the coefficient of dynamic friction under dry conditions is expected to be higher, only the performance under wet conditions is required.

The test shall normally be undertaken in-situ but it is permissible in the case of prefabricated products for samples of the surface to be cut from rolls on site to be later tested in the laboratory.

Methods

Two methods are considered suitable for measuring the friction of installed surfaces. Method A involves the use of the British Transport and Road Research Laboratory Portable Skid Resistance Tester (see figure 1) shod with the soft rubber sole. Note that the minimum value of 0.5 corresponds to a scale reading of no less than 47 on the TRRL machine.

A standard CEN rubber slider according to EN 13036-4, spring loaded beneath a foot mounted on the end of a pendulum arm, is allowed to swing down from a fixed position at 90° to the surface, slide along the surface for a preset distance, and swing through taking a “lazy pointer” with it, which remains at the top of the swing against a fixed scale.

The apparatus is set level on the surface with the legs supported on “spreader” plates to prevent localized deflection of the surface beneath the legs as the pendulum swings through its arc. The head is raised so that the pendulum swings clear of the surface. The arm is allowed to swing freely from its normal release position and the scale reading noted. If this is not zero, the friction rings are adjusted and the process repeated until a zero reading is consistently obtained.

Lower the arm and adjust the height setting until the slider just touches the surface, from one side of the vertical to the other side, a distance of between 125mm and 127mm. Lock the height setting in this position and recheck the distance of travel. Place the pendulum in the release position.

Flood the test area with clean water, release the pendulum and ignore the first reading. Release the pendulum five further times and record the scale reading obtained after each swing. Calculate the mean of all five readings. This is the wet result.

If the surface appears to have a directional pattern or texture, additional results shall be obtained with the apparatus set in such a way that the slider traverses the same area of surface at 90° and at 180° to the original direction of travel used for the first set of readings.

Method B involves the use of the Stuttgart sliding test apparatus (see figure 2). A vertical shaft of diameter 20mm is arranged in a frame, the lower part of which is designed as a threaded spindle (of pitch 12mm/turn). The shaft is guided at the top by a plain bearing and at the bottom by a ball bearing having a radial and screw-shaped axial action so that the shaft moves downwards when turned clockwise and upwards when turned counter-clockwise. At the lower end of the shaft a test foot is mounted on a pivoted mound (ball joint) such that rotation of the shaft is transferred to the test foot.

The ball bearing is arranged in a bracket on the frame, so as to permit vertical movement of the ball bearing. Downward movement is limited by a stop. A circular flange is fixed to the middle part of the shaft. Weights can be placed on the shaft. A constant torque is applied to the shaft by a steel wire wound over a 54mm winding drum and down onto the shaft. The steel wire runs over a guide pulley and is tensioned by a freely suspended 5kg weight. This torque drives the shaft.

The test foot contains a strain gauge or piezo-electric device for measuring the torque. The test foot consists of a lower and an upper part, between which the measurement sensors are arranged. The lower surface of the test foot has three skids, each being a 20mm wide by 45mm long segment of a 50mm diameter cylinder, arranged as shown. These skids are covered with test soles cut from leather that is finished with 100-grade abrasive paper (grinding procedure with the sliding direction). The leather shall be old tanned with a Shore D hardness of 60 plus or minus 5. The leather skid soles should be 2mm thick.

The total weight of the shaft, the mounted weight and the testing foot = 20 +/- 1kg. The polar inertia moment of the shaft, the mounted weight and the testing foot should be about 2900kgcm². Required measurement range for torque is 0 to 4Nm with an accuracy of 0.5%.

The synthetic surface is thoroughly wetted with clean water. The apparatus is placed on the synthetic surface, and the shaft is raised causing the steel wire to wind on to the drum. The shaft is then released so that the weights drive the shaft downwards. As the test sole contacts the surface, the rotation of the shaft is braked by the frictional resistance between the sole and the surface and this is measured as torque, which is continuously plotted with a recording device.

The shaft is turned far enough upwards before the measurement to ensure that the test foot contacts the surfacing after one rotation. Three measurements are carried out at each test position, and the test sole and the surface must be cleaned of abraded material between each test.

The measurement plots consist of a curve of torque against time and a curve of normal load against time. To determine the coefficient of sliding friction, the friction resistance at the transition from the initial sliding to steady sliding is used. The sliding friction coefficient is determined from the friction resistance at the point of intersection as follows:

$$E = 0.30 \frac{D}{V}$$

where D = relevant friction resistance (N cm) and
 V = normal force in N

In each case, the arithmetic mean is calculated from the three individual measurements made at each location. The results must be reported to two decimal places.

Using either Method, at least one measurement shall be made for every 1000m² of normal thickness synthetic surface, with a minimum of six measurements over the facility. The test positions shall be as follows:

1. At the discretion of the test laboratory in any lane around the first radius*
2. At the position of apparent lowest texture in any lane on the back straight*
3. At the discretion of the test laboratory in any lane around the final radius*
4. At the position of apparent lowest texture in lane 1 on the main straight*
5. At the discretion of the test laboratory at any position (except the high jump take-off point) over the semi circular area. Where there are two semi circular areas, a test shall be performed on each of them
6. At the discretion of the test laboratory at any position on one of the runways

If the area of the facility is exceptionally large (for example 10 or 12 lane straights), any necessary additional tests shall be performed at locations selected by the test laboratory.

Each test location shall be marked on a plan of the facility with the results recorded in the report.

2.7 Tensile Properties

Requirements

The tensile strength and elongation at break of a surface material will provide an indication of the durability of the surface. When determined using the method below, the minimum tensile strength shall be 0.5MPa for non-porous surfaces and 0.4MPa for porous surfaces. In applying these minima, sandwich systems shall be considered to be non-porous. For all surfaces, the elongation at break shall be a minimum of 40%. The test shall be conducted on a minimum of four samples and the result quoted is the average of the four results.

Method

In the case of newly installed tracks, it is sometimes acceptable to conduct this test on sample 'trays' of synthetic surface prepared by the contractor as work proceeds, or in the case of prefabricated surfaces on samples cut from individual rolls of material on site. However, in the event of dispute or if the quality of the installed surfacing is suspect, samples must be taken from the track itself.

If it is necessary to cut samples of surfacing from the track for this test, these should obviously be removed, where possible, from non-critical areas of the facility such as run-outs at the ends of straights, at the corners of fan areas etc. In the event that samples must be removed from a specific location because a defect is suspected, these samples should be cut from a low-wear area within that location.

In the case of prefabricated products, it is recommended that samples are removed across a number of the bonded seams, in order that the strength of the bond can be assessed.

Note: it may prove necessary to remove some of the wearing course of the macadam base, if a cohesive sample of the synthetic surface is to be obtained. All areas, from which samples have been removed, should be repaired immediately with fresh synthetic surfacing.

The tensile strength and elongation at break shall be determined on dumbbell bars stamped or cut from a full thickness sample of the surfacing. The shape of the specimens shall be as shown in figure 3. The bars shall be conditioned at 23°C for 24 hours and then stretched at a constant strain rate of 100 mm/minute until they break. A stress/strain curve may be plotted during the test.

In the case of synthetic surfacing formed with the use of single component, moisture-curing polyurethanes, at least 14 days curing time should be allowed before conducting tensile tests. If such a system fails to meet the stipulated limits, repeat tests should be conducted on further samples after another 14 days, or after a period of accelerated curing in the laboratory.

Each test location shall be marked on a plan of the facility, and the results obtained on samples from each location included in the test report.

2.8 Colour

Requirements

The evenness of the colour of the running surface assists in the concentration of the athlete and provides a focus in relation to the line and event markings. The colour must be consistent within the design of the surface and when fading occurs, this must occur evenly. The colour shall be uniform to within one position on the recognised colour reference card or plate system used. For deliberately designed multi-colour facilities each discrete colour shall be similarly uniform.

Method

There are a number of different assessment systems for colour. Most utilise some form of colour chart or series of colour cards or plates. Any system used for assessing colour must be capable of identifying and if necessary quantifying, the consistency of the colour of the surface over the facility.

Areas of inconsistent colour shall be marked on a plan of the facility.

2.9 Drainage

Requirements

Water in excess of the height of the texture of the running track surface can affect the safety and performance of the athlete. When completely covered with water and allowed to drain for 20 minutes, there shall be no area of synthetic surface where the depth of residual water exceeds the depth of texture of the surface.

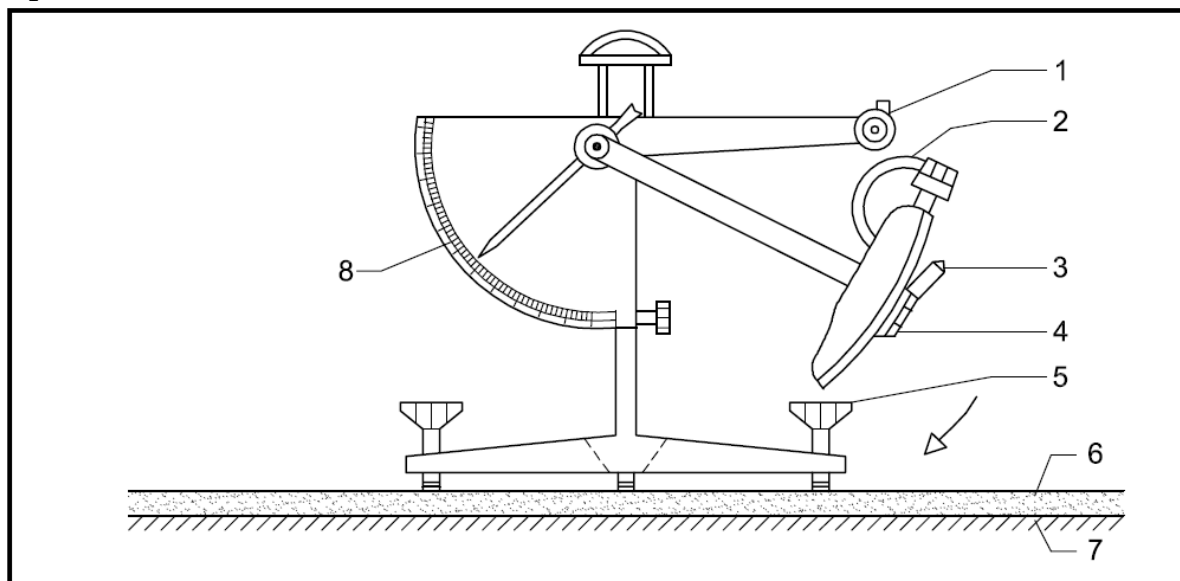
Method

The synthetic surface is flooded with water by any appropriate means and the 20 minutes is measured from the time the flooding stops. After that time, the surface is examined for standing water. Locations with standing water above the top of the surface texture of the synthetic surface with the approximate square metres and the maximum depth of the water are noted on a plan of the facility and included in the report.

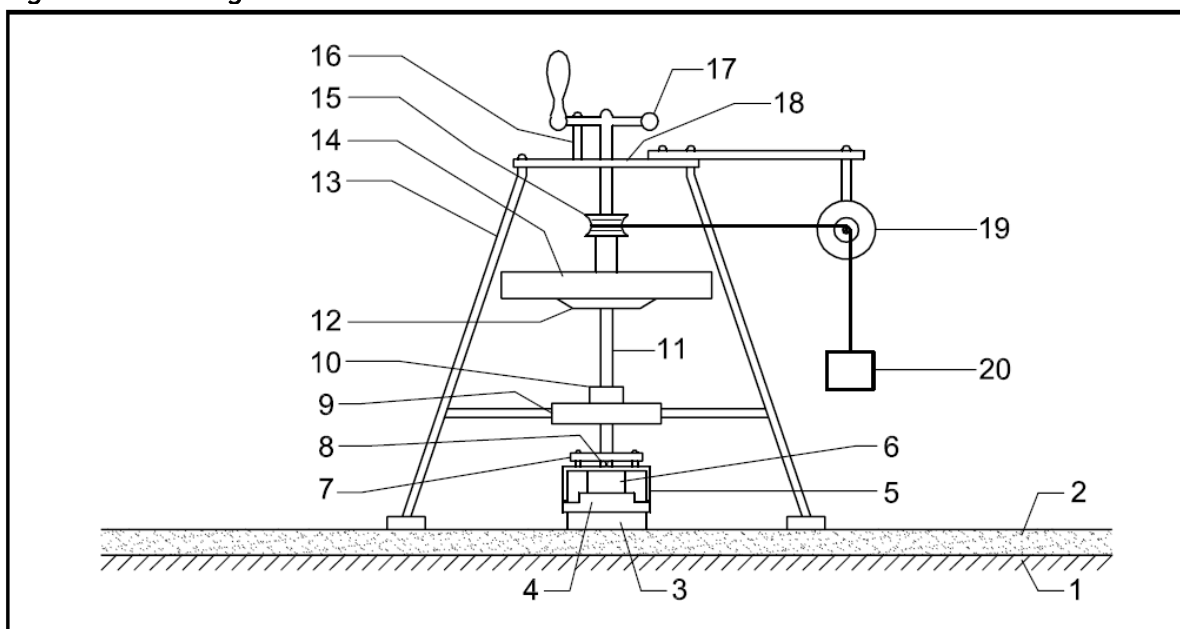
Note: it is sometimes difficult to deliver the necessary quantities of water to the surface from a hose supply. In this event, it may be necessary to evaluate this parameter just after heavy rainfall, if this is possible. Alternatively, selective watering from a hose supply should be applied to those areas of the facility which are particularly susceptible to water run-off problems, such as the fan areas.

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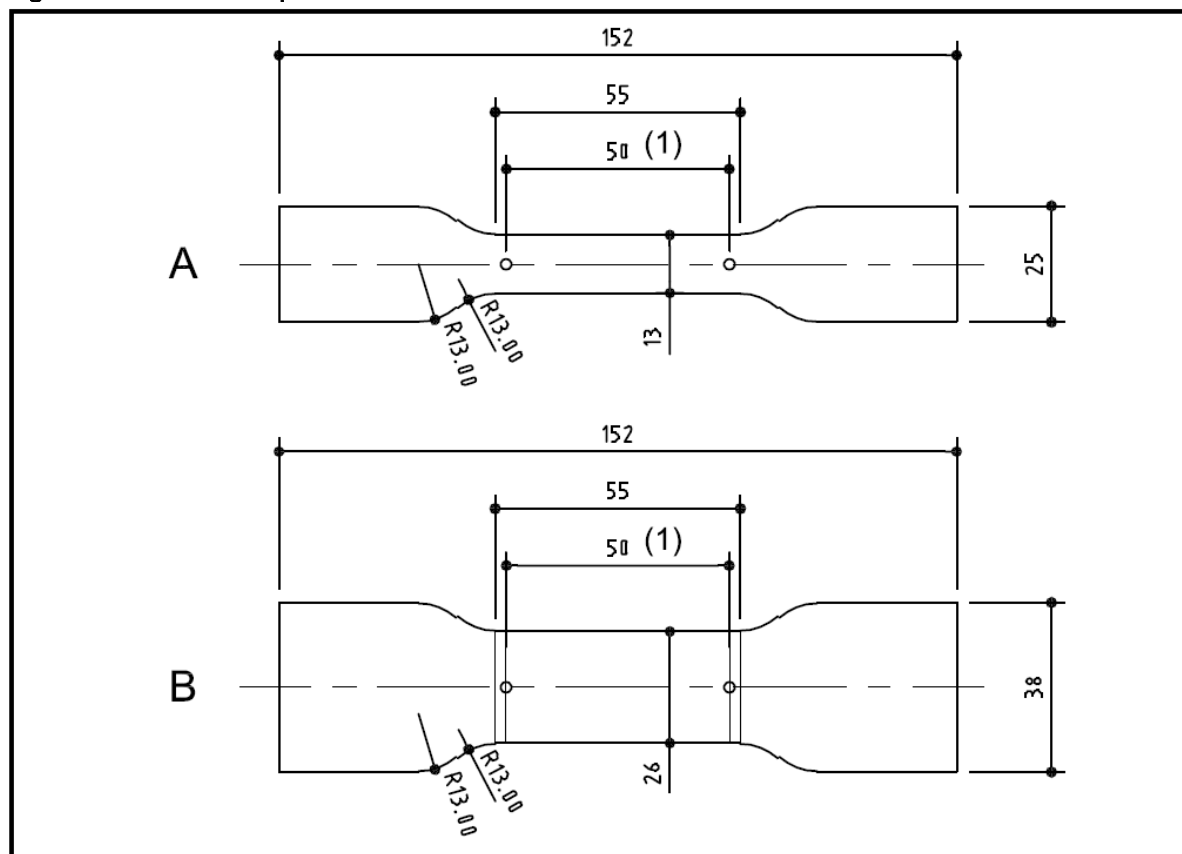
Figures to follow

Figure 1 - Portable Skid Resistance Tester (Friction Method A)


1 Release catch, 2 lifting handle, 3 pin F, 4 rubber slider, 5 foot of support, 6 synthetic surface, 7 base, 8 scale

Figure 2 - Sliding Resistance Tester (Friction Method B)


1 Base, 2 synthetic surface, 3 bottom plate, 4 lower part of test foot, 5 upper part of test foot, 6 electrical detector, 7 soft rubber disc, 8 ball joint, 9 ball bearing holder, 10 ball bearing, 11 threaded spindle, 12 support flange, 13 frame, 14 weights, 15 winding drum, 16 catch lever, 17 hand wheel, 18 plain bearing, 19 potentiometer for measuring the speed of rotation, 20 freely suspended weight

Figure 3 - Tensile Specimens (Dimensions in mm)

Sample A, Sample B, Gauge length