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Synthetic materials sports field surfaces

合成材料运动场地面层

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Table of Contents

Foreword.....	3
1 Scope	5
2 Normative references.....	5
3 Terms and definitions.....	6
4 Product categories	7
5 Requirements.....	7
6 Test methods.....	9
7 Inspection rules	11
8 Site foundation requirements and surface construction conditions	13
Appendix A (Informative) Technical safety documents	14
Appendix B (Normative) Test method for shock absorption of surface layer of synthetic material sports field.....	16
Appendix C (Normative) Testing method of vertical deformation of surface layer of synthetic material sports field.....	19
Appendix D (Normative) Testing method of anti-slip value of surface layer of synthetic material sports field.....	22
Appendix E (Normative) Testing method of flame retardancy	25

Synthetic materials sports field surfaces

1 Scope

This standard specifies the terms and definitions, product classification, requirements, test methods, inspection rules, site foundation requirements, surface construction conditions for the surfaces of synthetic material sports fields (hereinafter referred to as the surface).

This standard is applicable to the surface of track and field, ball games and multi-purpose sports fields, which are laid with synthetic materials outdoors.

This standard does not apply to occasions where climbing, sitting, lying are required.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 529 Rubber, vulcanized - Determination of tear strength (trouser, angle and crescent test pieces)

GB/T 2941 Rubber - General procedures for preparing and conditioning test pieces for physical test methods

GB/T 10654 Flexible cellular polymeric materials - Determination of tensile strength and elongation at break

GB/T 16422.2-2014 Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc sources

GB/T 19995.2-2005 Technical requirements and test methods for natural material sport fields - Part 2: Wooden floor for multipurpose gymnasium

GB/T 20033.2 Technical requirements and test methods for artificial material sports fields - Part 2: Tennis court

GB/T 20033.3 Technical requirements and test methods for artificial material sport fields - Part 3: Artificial turf surface for football fields

GB/T 30314 Rubber or plastic-coated fabrics - Determination of abrasion resistance

- Taber abrader

GB 36246-2018 Sports areas with synthetic surfaces for primary and middle schools

GB 50268 Code for construction and acceptance of water and sewerage pipeline works

CJJ 1 Code for construction and quality acceptance of road works in city and town

Athletics field facilities standard manual (IAAF)

3 Terms and definitions

The following terms and definitions apply to this document.

3.1

Surface layers of athletic fields

A track-and-field surface layer, which is laid with synthetic material.

3.2

Surface layers of sports field for ball games

Court floors, which are made of synthetic materials, for basketball, volleyball, badminton, tennis, football.

3.3

Synthetic surfaces intended for multi-sports facilities

Surface layers for recreational fitness activities, which are made of synthetic materials.

3.4

Permeable surface

A synthetic material sports surface layer, which has a pore structure, AND on which the water is in the form of both surface runoff and permeable surface flow.

3.5

Non-permeable surface

A synthetic material sports surface, which has a dense structure AND on which the water on the surface is only in the form of surface runoff.

3.6

Prefabricated surface

A synthetic material sports surface layer, which is made by using adhesives or other methods, to lay the surface layer material, on the foundation.

3.7

In-situ casting surface

A synthetic sports surface, which is formed by casting in site and paving the factory-produced prepolymers and other raw materials.

4 Product categories

4.1 The surface layer is divided into the following three categories, according to its scope of application:

- The surface layer of the athletic field;
- The surface layer of sports field for ball games;
- The synthetic surfaces intended for multi-sports facilities.

4.2 The surface layer is divided into the following two categories, according to its structure type:

- Permeable surface layer;
- Non-permeable surface layer.

4.3 The surface layer is divided into the following two categories, according to its paving method:

- In-situ casting surface layer;
- Prefabricated surface layer.

5 Requirements

5.1 Surface properties

5.1.1 Surface layer of athletic field

The performance of the surface layer of the athletic field, as well as the corresponding test methods, shall comply with the provisions of Table 1.

6.2 Thickness

6.2.1 Sample thickness

6.2.1.1 Prefabricated surface layer: Use a thickness gauge, which has an index of 1/100 mm, a pressure of (22 ± 5) kPa, a foot diameter of 6 mm, to make measurement. The measurement point is selected as follows: from the inside 20 mm from the end, randomly select five points, along the width direction, to measure the thickness. The arithmetic mean of the five points is taken as the result.

6.2.1.2 In-situ casting surface layer: The thickness of the in-situ casting surface layer sample, with anti-skid structure, shall be measured by a vernier caliper, which has an accuracy of not less than 0.1 mm. At least ten different positions shall be arbitrarily selected, to measure the thickness, at the five convex points and five concave points from the bottom to the surface, respectively. The result is the arithmetic mean of ten measurement results. For the thickness of the in-situ casting surface layer sample, with smooth surface, is measured by the method of 6.2.1.1.

6.2.2 Surface layer thickness of fields

The three-needle thickness detector (accuracy: ± 1 mm) is used to make measurement. The measured points and quantities shall meet the requirements of the surface layer of the relevant sports field. The arithmetic mean of all the measurement points is taken as the result.

6.3 Shock absorption

Make measurement, according to the method specified in Appendix B.

6.4 Vertical deformation

Make measurement, according to the method specified in Appendix C.

6.5 Anti-slip value, coefficient of friction

Make measurement, according to the method specified in Appendix D.

6.6 Tensile strength, elongation at break

Make measurement, according to the method specified in GB/T 10654; the tensile speed is (100 ± 10) mm/min.

6.7 Tear strength

Make measurement, according to the method specified in GB/T 529. Adopt the right-angle sample without cut; take the median of five specimens as the test result.

6.8 Ball bounce rate

(1 piece for testing, 2 pieces for sample preparation).

7.2.2 Sampling method

7.2.2.1 In-situ casting surface layer

7.2.2.1.1 The samples at the construction site shall be randomly prepared in parallel, according to the construction sequence, under the witness of the user, the construction party, the supervisor.

7.2.2.1.2 The end time of the reaction of the sample, under on-site conditions, is at least 14 d. After curing, the sample is packed in polyethylene or polytetrafluoroethylene bags AND placed in a cool and dry place. The project name, sampling date, sampling person, relevant special instructions shall be indicated on the packaging. Samples are valid for 6 months.

7.2.2.1.3 If the reaction of the construction site samples is not completely completed, within 14 days, THEN, the reaction time can be appropriately extended; however, the longest reaction time shall not exceed 28 days.

7.2.2.2 Prefabricated surface layers

7.2.2.2.1 Under the witness of the user, the construction party, the supervisor, randomly select a roll on site. Cut it at the middle position, which is 2 m away from the end.

7.2.2.2.2 The samples are packed in polyethylene or polytetrafluoroethylene bags AND placed in a cool and dry place. The project name, sampling date, sampling person, relevant special instructions shall be indicated on the packaging. Samples are valid for 6 months.

7.3 Inspection classification

7.3.1 Control inspection

During the construction process, samples shall be taken, according to the provisions of 7.2.2. The control inspection shall be carried out, in accordance with the relevant provisions of 5.1 ~ 5.2.

7.3.2 Type inspection

All technical requirements, which are listed in this standard, are type inspection items. The type inspection shall be carried out, usually in one of the following situations:

- a) Trial type identification of new products;
- b) When there are major changes in the structure, design, process, materials, production equipment, management, etc. of the product, which may affect the performance of the product;

- c) Resumption of production after production transfer, factory transfer, or suspension of production;
- d) When there is a big difference, between the control inspection results and the type inspection;
- e) During normal production, inspection shall be carried out once a year.

7.4 Judgment rules

When the control inspection results meet the relevant requirements of Chapter 5, it is judged to be qualified. When one of the inspection results is unqualified, double amount of samples shall be taken, for re-inspection of the unqualified item. If it is still unqualified, the batch of products shall be judged as unqualified.

8 Site foundation requirements and surface construction conditions

8.1 The technical requirements for the infrastructure and structures of the sports venues shall be implemented, in accordance with the relevant technical requirements of “Urban expressway and trunk road” in CJJ 1. The technical requirements, for the supporting water supply and drainage pipeline engineering, shall be implemented in accordance with GB 50268. Among them, for the indicators such as flatness, slope, site size, if they belong to track and field venues, it shall be implemented in accordance with the “Standard manual of track and field venue facilities”; if they belong to other sports venues, it shall be implemented in accordance with the corresponding professional sports technology requirements, AND clearly indicated in the contract.

8.2 Before the construction of the surface layer, the asphalt concrete site shall be naturally cured for more than 28 days. The cement concrete site shall be naturally cured, for more than 7 days, after the moisturizing curing period expires.

8.3 The construction of the surface layer shall be closed and enhanced bonding treatment, according to the conditions of the base layer, to ensure the quality of the surface layer of synthetic materials.

8.4 The construction shall avoid rainy days and weather which has a wind force above grade 5. The temperature should be within 10 °C ~ 35 °C. The ground shall be dry.

8.5 Surface construction should not be carried out, when large-scale decoration works are carried out nearby OR there is significant environmental pollution.

- c) The diameter of the coil spring is (69 ± 1) mm, which has a hard quenched upper plate. In the range of 0.1 kN ~ 7.5 kN, it has a linear stiffness of (2000 ± 60) N/mm. The spring shall consist of 3 or more coaxial coils, which are fixed together at the ends. This spring may also be milled from the same piece of steel.
- d) Steel force measuring bench: its bottom surface is spherical curved surface; the radius is 500 mm; the edge chamfering radius is 1 mm; the diameter of the force measuring bench is (70.0 ± 0.1) mm; the thickness is not less than 10 mm.
- e) Base sleeve: the inner diameter is (71.0 ± 0.1) mm.
- f) Test feet: It consists of steel force measuring bench, force sensing device, spring, upper plate (minimum thickness 20 mm, based on the measurement value at the center of the plate); it is placed in the base sleeve; the total mass of the test feet is (3.5 ± 0.35) kg.
- g) Weight lifting and releasing device: It can make it fall from the set height; the error is not more than ± 0.25 mm.
- h) A device, which has means for regulating and recording the output signals of the force sensor AND means for displaying these recordings.
- i) The channel frequency of the adjustment amplifier shall not be less than 1 kHz; the adjustment amplifier shall be matched or combined with a low-pass filter, which has a second-order Butterworth characteristic critical frequency of 120 Hz; the duration of capturing the impact peak value is 0.01 s; the maximum error is 0.5%.
- j) The test foundation shall be a flat, hard, vibration-free concrete floor, which can obtain the F_c data required in B.3.

B.2 Detection method

B.2.1 Test of concrete surface impact force F_c

Place the testing instrument, vertically on the concrete floor. Adjust the lower end of the impact weight, to a height of (55 ± 0.25) mm right above the upper plate. Release the weight. Record the peak value of the impact force on the concrete surface, during the impact process. Repeat the above process 10 times, resulting in a total of 11 impacts. Record the average of the peaks, from the 2nd to the 11th impact; denote it as F_c . The value of F_c shall be within the range of (6.60 ± 0.25) kN. If the value is outside this range, the result shall be considered invalid. F_c value's testing interval does not exceed 3 months.

B.2.2 Test of surface impact force F_s synthetic material surface

The test point is at least 20 cm from the edge of the sample. Place the testing instrument

vertically on the sample. Adjust the lower end of the impact weight, to a height of (55 ± 0.25) mm right above the upper plate. Release the weight. Record the peak value of the impact force on the surface of the synthetic material, during the impact. Within 5 s after the impact, lift the impact weight. Re-position on its support mechanism, so that the surface layer can recover, before the next impact. The procedure is repeated 2 times, at an interval of (60 ± 10) s, resulting in a total of 3 impacts. Record the average of the peaks of the 2nd and 3rd impacts; denote it as F_s .

If a further test is to be carried out on the same sample, it shall be carried out at a new location. The test position interval at any other location shall not be less than 100 mm.

In laboratory testing, samples shall be placed at a temperature of $(23 \pm 2) ^\circ\text{C}$, for at least 40 hours, before testing. The field testing shall be carried out, within a temperature range of $10 ^\circ\text{C} \sim 40 ^\circ\text{C}$. If the surface temperature of the surface layer is not within this range, it is permissible to use the interpolation method, to correct the results obtained by comparing the data curve and the force conversion curve, which is measured on the qualified surface.

B.3 Result calculation

Shock absorption is calculated according to formula (B.1). The value is accurate to 0.1%:

$$R = \left(1 - \frac{F_s}{F_c} \right) \times 100 \% \quad \dots\dots\dots (\text{ B.1 })$$

Where:

R - Shock absorption,%;

F_s - The test reading on the surface of the synthetic material, in Newton (N);

F_c - The test reading on the concrete surface, in Newtons (N).

B.4 Testing report

It shall include the following:

- a) Laboratory temperature;
- b) Number of tests;
- c) Measurement results;
- d) Special records;
- e) Tester and test date.

than 250 mm.

- c) Coil springs, which have a diameter of (69 ± 1) mm. It has a hard quenched upper plate; in the range of 0.1 kN ~ 1.6 kN, it has a linear stiffness of (40 ± 1.5) N/mm.
- d) Steel force measuring bench: its bottom surface is flat; the edge radius is 1 mm; the diameter of the force measuring bench is (70.0 ± 0.1) mm; the thickness is at least 10 mm.
- e) Base sleeve: the inner diameter is (71.0 ± 0.1) mm.
- f) Test feet, which consists of steel force measuring bench, force sensing device, spring, upper plate (minimum thickness 20 mm, based on the measurement value at the center point of the plate); it is placed in the base sleeve; the total mass of the test feet is (3.5 ± 0.35) kg.
- g) Weight lifting and releasing device: It can fall from the set height; the error is not more than ± 0.25 mm.
- h) The sensor, which is used for testing deformation, can be an electronic deformation sensor, which has a test range of ± 10 mm AND an error of no more than 0.05 mm. The distance between the sensor and the central axis of the entire test instrument shall not be greater than 125 mm. The two sensors shall be placed on the deformation force transmission device, symmetrically with the central axis of the instrument.
- i) The device, which has the means for regulating and recording the output signal from the force transducer AND means for displaying these recordings.
- j) The channel frequency of the adjustment amplifier shall not be less than 1 kHz. The adjustment amplifier shall be matched or combined with a low-pass filter, which has a second-order Butterworth characteristic critical frequency of 120 Hz; the duration of capturing the peak value of the impact force is 0.01 ms.
- k) The test foundation shall be a flat, hard, vibration-free concrete floor.

C.2 Testing method

During the test, the test point shall be at least 20 cm from the edge of the sample. Place the testing instrument, vertically on the sample. Adjust the lower end of the impact weight, to a height of (120 ± 0.25) mm right above the upper plate. Release the weight. Record the force applied to the surface during the impact and the resulting deformation. Within 5 s after the impact, the impact weight is lifted and repositioned on its support mechanism, so that the surface layer can recover before the next impact. The procedure is repeated 2 times, at an interval of (60 ± 10) s, resulting in a total of 3 impacts. Record the average value of the peak value of the 2nd and 3rd impact. If further tests are to be carried out on the same sample, they shall be carried out at a new location; the test

Appendix E

(Normative)

Testing method of flame retardancy

E.1 Scope of application

This method is suitable for judging the flame retardancy of the surface layer of the horizontal synthetic material sports field, under the action of moderate flame.

E.2 Class-I flame retardancy

Indicates that under the action of flame, when the combustion is extinguished, the diameter of the burning plaque, which is left on the surface of the synthetic material, is less than or equal to 50 mm.

E.3 Preparation of specimen

The specimens shall be cut from different positions of the test object. The specimen size is 100 mm × 100 mm. Generally, 5 specimens shall be measured for each test. Before the test, the specimen shall be standing for at least 48 h, under standard laboratory conditions.

E.4 Instruments and reagents

E.4.1 A fiber layer disc composed of overlapping cotton fiber fabrics, which have a diameter of 25 mm (e.g.: thin cotton cloth).

E.4.2 Ethanol, which has a concentration of 96%.

E.4.3 A graduated cylinder, which has a capacity of 10 mL or a 2.5 mL pipette.

E.4.4 Air-dried wood planks, which have a thickness of 20 mm, at least same as the size of the specimen.

E.4.5 Steel ruler, which has an accuracy of 0.5 mm.

E.5 Determination steps

The test shall be carried out in a non-ventilated place. In the middle of the specimen is placed a disc of overlapping fiber layers, which have a mass of 0.8 g. The fiber layer disc is soaked evenly, in 2.5 mL of ethanol; then ignited and allowed to burn naturally. When the burning flame and afterglow are extinguished, measure the diameter of the burning plaque, which is left on the surface of the specimen (accurate to 1 mm).

During combustion, if the fiber layer is turned over AND affects the size of the burning

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