भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDRADS

<u>Draft For Comments Only</u> Doc: TXD 30 (26517) WC
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भारतीय मानक मसौदा

मृदा सुदृढ़ीकरण के लिए भूकृत्रिम की दीर्घकालिक शक्ति की निर्धारण के लिए दिशानिर्देश

(आई एस 17365 : 2020 *का पहला पुनरीक्षण)*

Draft Indian Standard

Guidelines for the Determination of the Long-term Strength of Geosynthetics for Soil Reinforcement

(First Revision of IS 17365 : 2020 *)*

ICS : 59.080.70

Geosynthetics Sectional Committee , TXD 30 Last date for receipt of comments is 16 October 2024

NATIONAL FOREWORD

(*Formal clauses will be added later*)

This Indian Standard intended to be adopted is identical with ISO/TS 20432 : 2022(en) ‘Guidelines for the determination of the long-term strength of geosynthetics for soil reinforcement ’ issued by the International Organization for Standardization (ISO).

The standard was originally published in 2020. The first revision of the standard has been undertaken to align it with the latest version of ISO/TS 20432 : 2022. The major changes in this revision are as follows:

— Subclause 7.4 has been modified to further detail and clarify the fitting of linear regression curves to time-temperature block shifted creep-rupture test results.

Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words ‘International Standard’ appear referring to this standard, they should be read as ‘Indian Standard’.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In the standard intended to be adopted, reference appears to certain International Standard for which Indian Standard also exist. The corresponding Indian Standard which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 10318-1 Geosynthetics — Part 1: Terms and definitions	IS 13321 (Part 1) : 2022 Geosynthetics part 1 terms and definitions (*first revision*)	Identical with ISO 10318-1 : 2015

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

Extract of ISO/TS 20432:2022(en) 'Guidelines for the determination of the long-term strength of geosynthetics for soil reinforcement'

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 221, *Geosynthetics.*

This first edition of ISO/TS 20432 cancels and replaces ISO/TR 20432:2007, which has been technically revised. It also incorporates the Technical Corrigendum ISO/TR 20432:2007/Cor 1:2008.

The main changes are as follows:

- — Subclause 7.4 has been modified to further detail and clarify the fitting of linear regression curves to time-temperature block shifted creep-rupture test results.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

1 Scope

This document provides guidelines for the determination of the long-term strength of geosynthetics for soil reinforcement.

This document describes a method of deriving reduction factors for geosynthetic soil-reinforcement materials to account for creep and creep rupture, installation damage and weathering, and chemical and biological degradation. It is intended to provide a link between the test data and the codes for construction with reinforced soil.

The geosynthetics covered in this document include those whose primary purpose is reinforcement, such as geogrids, woven geotextiles and strips, where the reinforcing component is made from polyester (polyethylene terephthalate), polypropylene, high density polyethylene, polyvinyl alcohol, aramids and polyamides 6 and 6,6. This document does not cover the strength of joints or welds between geosynthetics, nor whether these might be more or less durable than the basic material. Nor does it apply to geomembranes, for example, in landfills. It does not cover the effects of dynamic loading. It does not consider any change in mechanical properties due to soil temperatures below 0 °C, nor the effect of frozen soil. The document does not cover uncertainty in the design of the reinforced soil structure, nor the human or economic consequences of failure.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- ISO 10318-1, *Geosynthetics — Part 1: Terms and definitions*

3 Terms, definitions, abbreviated terms and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10318-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- — ISO Online browsing platform: available at https://www.iso.org/obp
- — IEC Electropedia: available at https://www.electropedia.org/

3.1.1 long-term strength

Load which, if applied continuously to the geosynthetic during the service lifetime, is predicted to lead to rupture at the end of that lifetime

3.1.2 reduction factor

Factor (≥ 1) by which the tensile strength is divided to take into account particular service conditions in order to derive the long-term strength

Note 1 to entry: In Europe, the term 'partial factor' is used.

3.1.3 characteristic strength

95 % (two-sided) lower confidence limit for the tensile strength of the geosynthetic, approximately equal to the mean strength less two standard deviations

Note 1 to entry: This should be assured by the manufacturer’s own quality assurance scheme or by independent assessment.

3.1.4 block shifting

Procedure by which a set of data relating applied load to the logarithm of time to rupture, all measured at a single temperature, are shifted along the log time axis by a single factor to coincide with a second set measured at a second temperature

3.1.5 product line

Series of products manufactured using the same polymer, in which the polymer for all products in the line comes from the same source, the manufacturing process is the same for all products in the line, and the only difference is in the product mass per area or number of fibres contained in each reinforcement element

3.2 Abbreviated terms

CEG	carboxyl end group
DSC	differential scanning calorimetry
HALS	hindered amine light stabilizers
HDPE	high density polyethylene
HPOIT	high pressure oxidation induction time
LCL	lower confidence limit
MARV	minimum average roll value
OIT	oxidation induction time
PA	polyamide
PET	polyethylene terephthalate
PP	polypropylene
PTFE	polytetrafluorethylene
PVA	polyvinyl alcohol
SIM	stepped isothermal method
TTS	time-temperature shifting

3.3 Symbols

A_i	time-temperature shift factor
b_a	gradient of Arrhenius graph
d_{50}	mean granular size of fill
d_{90}	granular size of fill for 90 % pass (10 % retention)
f_s	factor of safety
G, H	parameters used in the validation of temperature shift linearity (see 7.4)
m	gradient of line fitted to creep rupture points (log time against load); inverse of gradient of conventional plot of load against log time.
M_n	number averaged molecular weight

n	number of creep rupture or Arrhenius points
P	applied load
R_1	ratio representing the uncertainty due to extrapolation
R_2	ratio representing the uncertainty in strength derived from Arrhenius testing
$f_{R,CH}$	reduction factor to allow for chemical and biological effects
$f_{R,CR}$	reduction factor to allow for the effect of sustained static load
$f_{R,ID}$	reduction factor to allow for the effect of mechanical damage
$f_{R,W}$	reduction factor to allow for weathering
S_{sq}	sum of squares of difference of log (time to rupture) and straight line fit
S_{xx}, S_{xy}, S_{yy}	sums of squares as defined in derivation of regression lines in 9.4.3
σ_0	standard deviation used in calculation of LCL
t	time, expressed in hours
t_{90}	time to 90 % retained strength
t_D	design life
t_{deg}	degradation time during oxidation
t_{ind}	induction time during oxidation
t_{LCL}	LCL of time to a defined retained strength at the service temperature
t_{max}	longest observed time to creep rupture, expressed in hours
t_{n-2}	Student's t for $n - 2$ degrees of freedom and a stated probability
t_R	time to rupture, expressed in hours
t_s	time to a defined retained strength at the service temperature
T	load per width
T_B	batch tensile strength (per width)
T_{char}	characteristic strength (per width) (see 6.1)
T_x	unfactored long-term strength (see 9.4.3)
T_D	long-term strength per width (including factor of safety)
T_{DR}	residual strength
θ_j	temperature of accelerated creep test
θ_k	absolute temperature
T_{LCL}	LCL of T_{char} due to chemical degradation
θ_s	service temperature
x	abscissa: on a creep rupture graph the logarithm of time, in hours
$\bar{x}$	mean value of x
x_i	abscissa of an individual creep rupture point
x_p	predicted time to rupture
y	ordinate: on a creep rupture graph, applied load expressed as a percentage of tensile strength, or a function of applied load
y_0	value of y at 1 h (lg t = 0)
$\bar{y}$	mean value of y
y_i	ordinate of an individual creep rupture point
y_0	value of y at time 0, derived from the line fitted to creep rupture points

FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS

(Please use A4 size sheet of paper only and type within fields indicated. Comments on each clause/sub clause/table/fig etc. be started on a fresh box. Information in column 3 should include reasons for the comments and suggestions for modified working of the clauses when the existing text is found not acceptable. Adherence to this format facilitates Secretariat's work)

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Item, Clause Sub-Clause No. Commented upon (Use Separate Box afresh)	**Comments**	**Specific Proposal (Draft clause to be add/amended)**	**Remarks**	**Technical References and justification on which (2), (3), (4) are based**
(1)	**(2)**	**(3)**	**(4)**	**(5)**