



SLOVENSKI STANDARD
oSIST prEN 17282:2018
01-november-2018

Železniške naprave - Infrastruktura - Pod balastnimi preprogami

Railway applications - Infrastructure - Under ballast mats

Bahnanwendungen - Infrastruktur - Unterschottermatten

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: prEN 17282

<https://standards.iteh.ai/catalog/standards/sist/af0626d5-8a72-4234-a954-51ab4a1d5c2c/sist-en-17282-2020>

ICS:

93.100

Gradnja železnic

Construction of railways

oSIST prEN 17282:2018

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 17282

August 2018

ICS 93.100

English Version

Railway applications - Infrastructure - Under ballast mats

Bahnanwendungen - Infrastruktur -
Unterschottermatten

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents

	Page
European foreword.....	4
Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	7
4 Symbols and abbreviations	9
5 Track categories.....	11
6 Design approval tests and routine tests	11
6.1 General.....	11
6.2 Summary of design approval and routine tests	12
6.3 Requirements for specification of UBM	12
6.3.1 Dimensions and mass.....	12
6.3.2 Static and low frequency dynamic vertical bedding modulus determined with GBP	13
6.3.3 Higher frequency vertical bedding modulus.....	13
6.3.4 Fatigue test in ballast.....	14
6.3.5 Fatigue test with GBP (long term variation of bedding modulus).....	15
6.3.6 Compression test.....	15
6.3.7 Static horizontal bedding modulus of UBM	16
6.3.8 Water resistance and freeze-thaw resistance of UBM	16
6.3.9 Ageing test with high temperatures.....	16
6.3.10 Resistance to other environmental parameters.....	17
6.3.11 Environment and end of life.....	17
7 Data to be supplied.....	17
7.1 General.....	17
7.2 Data supplied by the purchaser	17
7.3 Data supplied by the supplier.....	18
7.3.1 Prior to the design approval tests.....	18
7.3.2 After the design approval tests and prior to first start-up of production	18
8 Rules for use of UBM	18
8.1 Rules for storage and installation of UBM.....	18
8.2 Rules to ensure functionality of UBM.....	19
9 Quality control	19
10 Marking, labelling and packaging	19
Annex A (normative) Geometric Ballast Plate (GBP)	20
A.1 Design of the GBP	20
A.2 Material of GBP	20
Annex B (normative) Data sheet.....	23
Annex C (normative) Bedding modulus measurement of UBM determined with GBP.....	25
C.1 Static test procedure.....	25
C.1.1 Principle	25
C.1.2 Apparatus.....	25

C.1.3	Procedure	26
C.1.4	Test report	28
C.2	Low frequency dynamic test procedure	28
C.2.1	Principle.....	28
C.2.2	Apparatus	28
C.2.3	Procedure	29
C.2.4	Test report	30
Annex D	(normative) Fatigue test on UBM in ballast.....	31
D.1	Principle.....	31
D.2	Apparatus	31
D.3	Procedure	32
D.4	Test report	33
Annex E	(informative) Fatigue test on UBM with GBP	34
E.1	Principle.....	34
E.2	Apparatus	34
E.3	Procedure	35
E.4	Test report	36
Annex F	(informative) Measurement of higher frequency vertical bedding modulus of UBM.....	37
F.1	Principle.....	37
F.2	Test parameters	37
F.2.1	Test arrangement	37
F.2.2	UBM test sample.....	38
F.2.3	Ambient Test temperature.....	38
F.2.4	Vibration test velocity.....	38
F.3	Procedure	38
F.4	Test report	39
Annex G	(informative) Static horizontal bedding modulus of UBM.....	41
G.1	Principle.....	41
G.2	Apparatus	41
G.3	Procedure	42
G.4	Test report	43
Annex H	(informative) Water resistance and freeze–thaw resistance of UBM	45
H.1	Principle.....	45
H.2	Apparatus	45
H.3	Procedure	45
H.4	Test report	47
Annex I	(informative) Ageing test with high temperatures of UBM	49
I.1	Principle.....	49
I.2	Apparatus	49
I.3	Procedure	49
I.4	Test report	50
Bibliography	51

prEN 17282:2018 (E)

European foreword

This document (prEN 17282:2018) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 17282:2020

<https://standards.iteh.ai/catalog/standards/sist/af0626d5-8a72-4234-a954-51ab4a1d5c2c/sist-en-17282-2020>

Introduction

In a track for railway vehicles, the under ballast mat (UBM) is a product which is placed between the substructure and the ballast layer. This document applies to the performance-related properties of this mat.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 17282:2020

<https://standards.iteh.ai/catalog/standards/sist/af0626d5-8a72-4234-a954-51ab4a1d5c2c/sist-en-17282-2020>

prEN 17282:2018 (E)**1 Scope**

This document is applicable to under ballast mats used in ballasted track and defines the test procedures and their evaluation criteria.

This document provides particular information in the following areas:

- test methods, test arrangements and evaluation criteria of under ballast mat;
- data supplied by the purchaser and by the supplier;
- definition of general process of design approval tests;
- definition of routine tests.

This document defines the specific test procedures for under ballast mat:

- stiffness tests;
- fatigue tests;
- number of tests for severe environmental condition.

This document also sets out procedures for testing fitness for purpose and provides information on quality monitoring as part of quality assurance procedures. This document does not, however, contain requirements pertaining to the functions of under ballast mats. It is the responsibility of the purchaser to define these requirements and to choose the optional tests.

2 Normative references

SIST EN 17282:2020

The following referenced documents are indispensable for the application 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.

EN 10027 (all parts), *Designation systems for steels*

EN 13450, *Aggregates for railway ballast*

EN 13674-1, *Railway applications – Track – Rail – Part 1: Vignole railway rails 46 kg/m and above*

EN ISO 1856, *Flexible cellular polymeric materials - Determination of compression set (ISO 1856)*

EN ISO 7500-1, *Metallic materials - Calibration and verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Calibration and verification of the force-measuring system (ISO 7500-1)*

EN ISO 9513:2012, *Metallic materials - Calibration of extensometer systems used in uniaxial testing (ISO 9513:2012)*

EN ISO 22768 (all parts), *General tolerances (ISO 2768, all parts)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

ballasted track

track in which the sleepers or bearers are supported by ballast

3.2

under ballast mat (UBM)

product of resilient material installed in track between substructure and ballast layer including all integral parts of the product

Note 1 to entry: The main objectives of the application of under ballast mats are to increase resilience in the track in order to improve the load distribution and/or to reduce vibrations transmitted to the surroundings, and by doing so providing vibration insulation.

3.3

stiffness

force per unit deflection, measured under a uniaxial force

3.4

bedding modulus

compressive stress (force per unit area) per unit deflection, measured under a uniaxial force

3.5

static stiffness or bedding modulus

force or stress per unit deflection measured under a uniaxial static load

3.6

low frequency dynamic stiffness or bedding modulus

force or stress per unit deflection measured under a uniaxial force which acts periodically at a frequency of (5 – 20) Hz between specific force or stress levels

Note 1 to entry: This value is determined mainly for calculation of dynamic deformation of tracks.

3.7

higher frequency dynamic stiffness or bedding modulus

force or stress per unit deflection measured under a uniaxial force or displacement, which acts periodically at a frequency of (10 – 160) Hz at a specific stress level

Note 1 to entry: This value will be determined as an input characteristic for vibration calculations. In contrast to the determination of low frequency dynamic stiffness or bedding modulus, this test will be determined under static preloading.

prEN 17282:2018 (E)**3.8
noise mitigation**

reduction of emission of structure borne noise into the surroundings

Note 1 to entry: UBM has no direct influence on noise-mitigation only in some indirect cases e.g. mitigate the reradiated sound from bridge-structures.

**3.9
vibration mitigation**

reduction of emission of mechanical vibration and/or structure-borne noise into the surroundings

**3.10
geometric ballast plate (GBP)**

rigid steel plate with a geometrically structured surface simulating ballast contact

Note 1 to entry: See Annex A.

**3.11
design approval test**

test performed to demonstrate the compliance of the product properties to the requirements, set by the purchaser

**3.12
routine test**

test performed to demonstrate the compliance of the product properties to the quality plan, set by the supplier

**3.13
purchaser**

operator or user of the equipment, or the customer of the material on the user's behalf

**3.14
supplier**

company /body responsible for the execution of purchaser's requirements

Note 1 to entry: This can be the manufacturer or his designated representative, stockist, distributor, or agent. The supplier is responsible for the use of the EN in response to the purchaser's requirements and will ensure all local conditions of purchase requirements are satisfied.

**3.15
manufacturer**

organization responsible for blending and processing material constituents, integrating them in the manufacturing process and subsequently cutting, stamping or moulding to final dimensions

4 Symbols and abbreviations

Table 2 — Symbols

Symbols	Characterization	Units
A	area	mm ²
a	acceleration in measurement of higher frequency stiffness	m/s ²
C	bedding modulus	N/mm ³
d	displacement	mm
Δ	variation	-
F	force	kN
f	frequency in measurement	Hz
k	stiffness	N/mm
L	point stiffness level for higher frequency stiffness	dB re 1 N/m
m	mass	kg
η	loss factor	-
N	number of cycles	-
p	pressure	N/mm ²
κ	stiffening ratio between dynamic bedding modulus and static bedding modulus	-
σ	stress (compressive or tensile)	N/mm ²
ω	angular frequency = $2\pi \cdot f$ (for higher frequency stiffness)	s ⁻¹

Table 3 — Indices of the symbols

Indices	Characterization
<i>0</i>	for frequency, definition of natural frequency
<i>i Hz</i>	value of frequency in measurement
<i>af</i>	after
<i>av</i>	average
<i>be</i>	before
<i>dyn</i>	low frequency dynamic
<i>H</i>	higher frequency
<i>h</i>	horizontal
<i>max</i>	maximum
<i>min</i>	minimum
'number' or <i>i</i>	sequential number in order to differentiate types of measurements
<i>pre</i>	preload
<i>stat</i>	static
<i>tend</i>	tendency
<i>test</i>	test load
<i>v</i>	vertical

<https://standards.iteh.ai/catalog/standards/sist/af0626d5-8a72-4234-a954-51ab4a1d5c2c/sist-en-17282-2020>

5 Track categories

For track categories, see Table 1.

Table 1 — Definition of Track Categories (TC) for tracks using under ballast mats according their typical specifications and use cases

	Axle load [kN]	Speed [km/h]	Rail profile as defined in EN 13674-1	Distance of sleeper supports or rail fastenings [mm]	Typical application
TC1	$\geq 100 \leq 130$	≤ 100	49E1	650 (maximum 750)	Urban light rail or industrial tracks
TC2	≤ 160	≤ 140	54E1	650	Urban light rail or industrial tracks
TC3	≤ 225	≤ 200	60E1	600	Conventional main traffic lines
	≤ 200	≤ 320	60E1	600	High-speed lines and tracks with large radius
	≤ 250	≤ 120	60E1	600	Freight lines
TC4	≤ 300	≤ 120	60E1	600	Mixed traffic including freight with heavy axle loads

6 Design approval tests and routine tests

6.1 General

This clause defines the objectives of tests and of demanded information about the UBM.

The purchaser should define the accepted laboratories.

The purchaser decides the way to choose the test sample units.

In order to be able to identify UBM at a later date, the following values shall be indicated:

- the specific mass of the product and all its components, see 6.3.1;
- the results of a suitable material analysis as selected by the manufacturer and approved by the purchaser.

The supplier shall provide sufficient data to satisfy the objectives of the tests and/or the provision of requested information in respect of UBM including:

- the data sheet as described in Annex B;
- any transportation, storage and installation recommendations and procedures to preserve the material characteristics and original performance.

Compliance with Category TC4 implies compliance with Categories TC1 – TC4 except for bedding modulus measurements.

prEN 17282:2018 (E)

Compliance with Category TC2 implies compliance with Categories TC1 and TC2 except for bedding modulus measurements.

6.2 Summary of design approval and routine tests

The design approval tests and the routine tests (for quality insurance and quality monitoring) are stated in Table 4.

The values determined in product qualification testing shall act as the reference values for quality assurance and quality monitoring procedures.

The frequency of routine tests is defined according to the quality plan of the supplier (see Clause 9).

Table 4 — Tests for UBM

Tests	Clause	Design approval tests	Routine tests
Dimensions and mass	6.3.1	Mandatory	Mandatory
Static and low frequency dynamic vertical bedding modulus determined with GBP	6.3.2	Mandatory for static, 5 and 10 Hz, optional for 20 Hz	Mandatory for static and 5 Hz at $(23 \pm 5)^\circ\text{C}$
Higher frequency dynamic vertical bedding modulus	6.3.3	Optional (but recommended if UBM is used for Vibration mitigation)	Not Applicable
Fatigue test with ballast	6.3.4	Mandatory	Not Applicable
Fatigue test with GBP	6.3.5	Optional (but recommended if UBM is used for vibrations attenuation)	Not Applicable
Compression test	6.3.6	Optional	Not Applicable
Static horizontal bedding modulus	6.3.7	Optional	Not Applicable
Water resistance and freeze-thaw resistance of UBM	6.3.8	Optional	Not Applicable
Ageing test with high temperatures	6.3.9	Optional	Not Applicable
Resistance to chemical agents	6.3.10	Optional	Not Applicable
Resistance to hydrocarbon	6.3.10	Optional	Not Applicable
Resistance to ozone	6.3.10	Optional	Not Applicable
Resistance to fire	6.3.10	Optional	Not Applicable
Environment and end of life	6.3.11	Optional	Not Applicable

6.3 Requirements for specification of UBM**6.3.1 Dimensions and mass**

The supplier shall indicate the range of available dimensions with tolerances of the UBM and type of joint (joint closing method as per supplier recommendation).

The thickness and mass of UBM shall be indicated in order to enable identification.

Test arrangement:

Thickness and mass are measured with suitable instruments (type of instruments validated by the purchaser).

Design approval:

All the UBM samples for design approval shall be checked according to technical documentations on thickness and mass.

The purchaser shall approve the technical documentation on thickness and mass given by supplier.

The values determined in design approval tests shall be the reference values for routine tests.

6.3.2 Static and low frequency dynamic vertical bedding modulus determined with GBP

The measurement of the static and of the low frequency dynamic vertical bedding modulus of UBM determined with GBP is a key performance property of the UBM.

Test arrangement:

The static and low frequency dynamic vertical bedding modulus of UBM with GBP shall be measured in accordance with Annex C.

The low frequency dynamic bedding modulus is measured at (5 ± 1) Hz and (10 ± 1) Hz (and optional frequency tests at (20 ± 2) Hz).

Design approval:

The test method shall be applied on 3 UBM samples. In the case of a profiled UBM (geometrically non-homogeneous cross section in one or two directions), 6 samples are required: 3 with maximum working surface, and 3 with minimum working surface. Average of those 6 values will be retained. If the difference between the static bedding modulus with minimum working surface and with maximum working surface is $\leq 5\%$, the further tests shall be performed with the same amount of samples as non-profiled UBM.

If this test is performed at other temperatures, then the median value sample shall be selected for performing this test.

The purchaser shall define the following acceptance criteria for the design approval test for a track category:

- minimum value $\leq C_{\text{stat}} \leq$ maximum value;
- minimum value $\leq C_{\text{dyn } 5\text{Hz}}$ or $C_{\text{dyn } 10\text{Hz}} \leq$ maximum value.

NOTE 1 $C_{\text{dyn } 20\text{Hz}}$ is an informative value.

The supplier shall provide the reference values for the static and the low frequency dynamic bedding modulus for routine test, based on the values of the design approval tests, in the range of the purchaser acceptance criteria.

NOTE 2 The relationship between values measured between flat plates (FP) and Geometrical Ballast Plate (GBP) is not linear and differs for static and dynamic bedding modulus values. Therefore a direct comparison between the values measured using the flat plates and geometric ballast plates GBP is not possible.

6.3.3 Higher frequency vertical bedding modulus

This requirement should verify the performance of vibration mitigation of UBM.