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Railway applications — Concrete sleepers and bearers for track —

Part 2: Prestressed monoblock sleepers

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Partie 2: Traverses monoblocs précontraintes

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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).

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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 269, *Railway applications*, Subcommittee SC 1, *Infrastructure*.

This document is used in conjunction with ISO 22480-1.

A list of all parts in the ISO 22480 series can be found on the ISO website.

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.

Railway applications — Concrete sleepers and bearers for track —

Part 2: Prestressed monoblock sleepers

1 Scope

This document defines additional technical criteria and control procedures related to the manufacturing and testing of prestressed monoblock sleepers.

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 22480-1, *Railway applications — Concrete sleepers and bearers for track — Part 1: General requirements*

ISO 22074-8, *Railway infrastructure — Rail fastening systems — Part 8: Determination of stiffness*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22480-1 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/

4 Symbols and abbreviated terms

For the purpose of this document, the symbols given in ISO 22480-1:2022, Clause 4 and the following apply.

Symbol	Description	Unit
F_c	load applied at the centre of the sleeper for positive bending test at the centre section	kN
F_{cB}	maximum test load which cannot be increased during positive bending test at the centre section	kN
F_{cBn}	maximum test load which cannot be increased during negative bending test at the centre section	kN
F_{cn}	load applied at the centre of the sleeper for negative bending test at the centre section	kN
F_r	load applied at the centre line of the rail seat for positive bending test at the rail seat section	kN
$F_{r,min,cyc}$	minimum cyclic test load for the rail seat section cyclic test; $F_{r,min,cyc}$ = min (50 kN; 0,4 × F_{r0}) unless specified otherwise by the purchaser.	kN

Symbol	Description	Unit
$F_{r,min,fat}$	minimum cyclic test load for the rail seat section fatigue test; $F_{r,min,fat}$ = 20 % of the maximum cyclic load	kN
L_c	design distance between centre lines of the rail seats	m
L_p	design distance between the centre line of the rail seat and the edge of the sleeper at the bottom	m
L_r	design distance between the articulated supports centre lines for the test arrangement at the rail seat section	m

5 Bending tests

5.1 General

This clause defines the testing regime and rules for the acceptance of prestressed monoblock sleepers.

The quality control plan shall define relevant dimensions and tolerances to be checked before carrying out bending tests, in accordance with ISO 22480-1:2022, Table 1. The sleepers for bending tests shall have a surface finish that allows correct execution of the tests.

A summary of tests to be carried out is given in Table 1.

NOTE For the definition of Method A and Method B, see ISO 22480-1:2022, 5.3.

Table 1 — Summary of tests

Product testing	Method A		Method B	
	Design approval tests	Routine tests	Design approval tests	Routine tests
Static positive bending test at the rail seat section	M according to Figure 5	M according to Figure 5	M according to Figure 4	M according to Figure 5
Static negative bending test at the centre section	M according to Figure 6	O according to Figure 6	M according to Figure 7	O according to Figure 6 or Figure 7
Static positive bending test at the centre section	N/A	N/A	O according to Figure 8	N/A
Cyclic test	N/A	N/A	M according to Figure 9	N/A
Fatigue test	O according to Figure 10	N/A	O according to Figure 10	N/A
Key M Mandatory tests O Optional tests N/A Not applicable				

5.2 Test arrangements

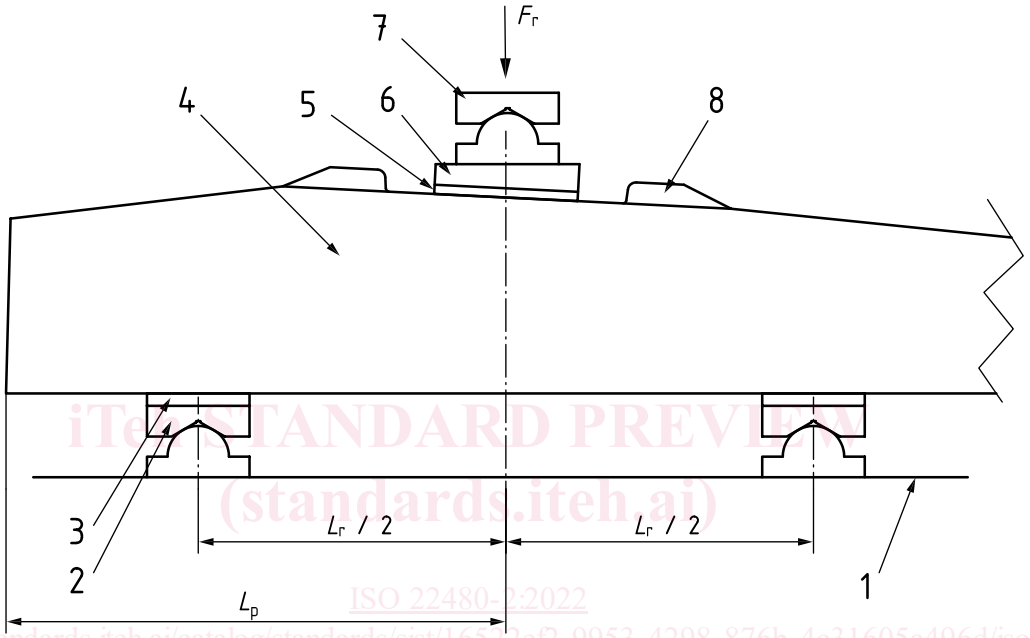
5.2.1 Rail seat section

The arrangement for the positive bending test at the rail seat section is shown in Figure 1.

The value of L_r in relation to L_p is detailed in Table 2.

The load F_r is applied perpendicularly to the base of the sleeper.

The end of the sleeper opposite to the end being tested shall be unsupported.



Key

1 rigid support
2 articulated support (in accordance with Annex A)
3 resilient pad (in accordance with Annex A)
4 prestressed monoblock sleeper
5 resilient rail pad (defined by the purchaser)
6 tapered packing (in accordance with Annex A)
7 articulated load point (in accordance with Annex A, necessary if the jack is not articulated)
8 cast iron shoulder or concrete shoulder of the fastening system

During the cyclic and fatigue test, lateral displacement of element "6" can occur. In this case, lateral stops can be inserted (part of fastening system such as guide plates or insulators) between 6 and 8 and/or a stiffer element "5" can be used. This amendment shall be agreed with the purchaser. The articulated support, the resilient pad, the tapered packing and the articulated load point shall be in accordance with Annex A.

Figure 1 — Test arrangement for positive bending moment at the rail seat section

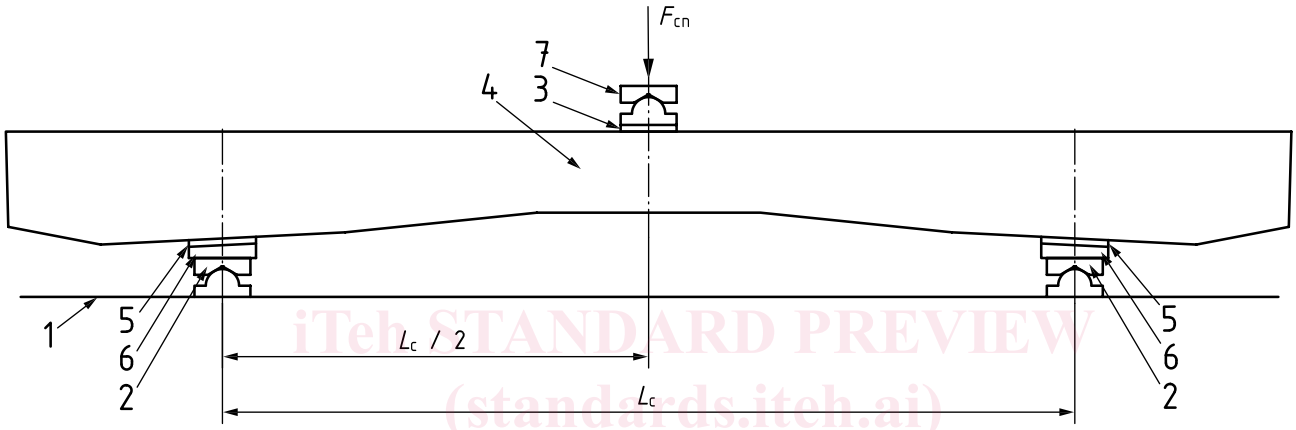
Table 2 — Value of L_r in relation to L_p

Dimensions in metres

L_p	L_r
$L_p < 0{,}349$	0,3
$0{,}350 \leq L_p < 0{,}399$	0,4
$0{,}400 \leq L_p < 0{,}449$	0,5
$L_p \geq 0{,}450$	0,6

5.2.2 Centre section

The arrangement for the negative bending test at the centre section is shown in Figure 2.

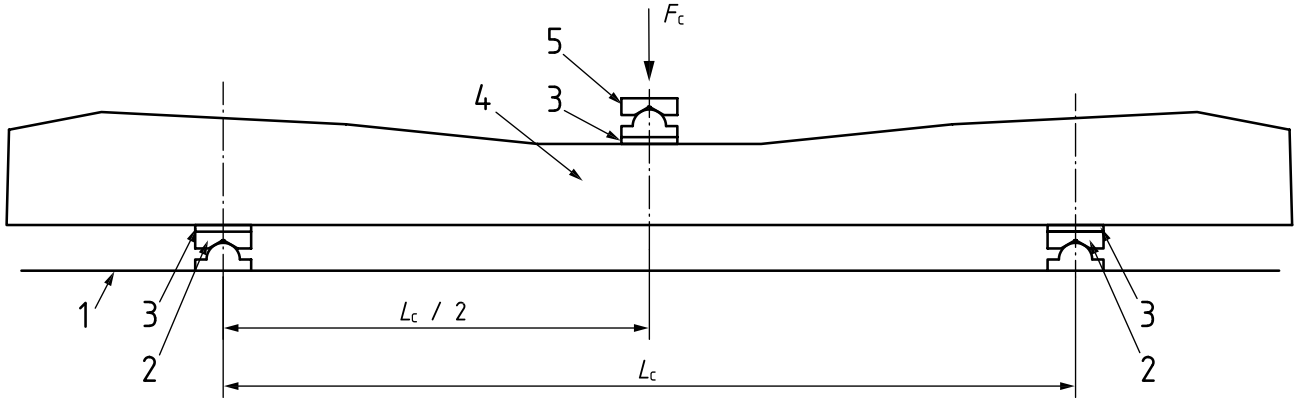


Key

1 rigid support
2 articulated support (in accordance with Annex A))
3 resilient pad (in accordance with Annex A)
4 prestressed monoblock sleeper
5 resilient rail pad (defined by the purchaser)
6 tapered packing (in accordance with Annex A)
7 articulated load point (in accordance with Annex A, necessary if the jack is not articulated)

Figure 2 — Test arrangement for negative bending moment at the centre section

The test arrangement for the positive bending test at the centre section is shown in Figure 3.



Key

1 rigid support
2 articulated support (in accordance with Annex A)
3 resilient pad (in accordance with Annex A)
4 prestressed monoblock sleeper
5 articulated load point (in accordance with Annex A, necessary if the jack is not articulated)

Figure 3 — Test arrangement for positive bending moment at the centre section

5.3 Test procedures

5.3.1 General

Storage conditions should be specified by the purchaser. The following precautions should be considered for the execution of the tests.

— Wipe clean all testing machine bearing surfaces and remove any loose grit or other extraneous material form the surface of the sleeper that will be in contact with the supports.

— For sleepers stored in water, wipe excess moisture from the surface of the sleeper before placing in the testing machine.

— Place the test sleeper in the machine, correctly centred and with the longitudinal axis of the sleeper at the right angles to the longitudinal axis of the upper and lower supports. Ensure that the reference direction of loading is perpendicular to the direction of casting of the sleeper. For the position of the supports, see 5.2.

— Do not apply the load until all supports are resting evenly against the sleeper.

The initial reference test loads shall be calculated according to 5.3.2. The test loads shall be applied according to procedures defined in 5.3.3, 5.3.4 and 5.3.5. Crack width shall be measured according to ISO 22480-1:2022, 9.2.

NOTE 1 Background information about test load levels for design approval tests and routine tests is given in ISO 22480-1:2022, Annexes A, B and C. Information about the determination of coefficients k_{1s}, k_{1d}, k_{2s}, k_{2d} and k_3 is given in ISO 22480-1:2022, Annexes B and D.

In the static tests and the cyclic test, specific values of crack width are used in part of the acceptance criteria. For these tests, the test load shall be increased until the measured crack width reaches the

specific value of crack width plus 0,01 mm (resolution of the microscope used). The load level preceding this test load level shall be used as the test result.

NOTE 2 A crack with a minimum crack width of 0,01 mm and crack width increasing with increasing test load is used as an indicator for first crack formation. Therefore, the test load is increased until a crack width of 0,02 mm is measured, in order to determine the test loads F_{rr}, F_{cr} or F_{crn}. This procedure reduces the impact on the test results for first crack formation caused by the storage conditions before testing. Crack width for test loads $F_{r0,05}$ and $F_{r0,5}$ is specified in ISO 22480-1:2022, Clause 4.

5.3.2 Initial reference test loads

The initial reference test loads (F_{r0}, F_{c0}, F_{c0n}) are those which produce the corresponding reference bending moment ($M_{0,r,pos}$, $M_{0,c,pos}$, $M_{0,c,neg}$) at the cross-section object of each test.

F_{r0} is calculated from the geometry given in Figure 1 and values from Table 2 using Formula (1):

$$F_{r0} = \frac{4\ M_{0,r,pos}}{L_r - 0,1} \tag{1}$$

F_{c0} and F_{c0n} are calculated from the geometry given in Figures 2 and 3 using Formula (2) and Formula (3):

$$F_{c0} = \frac{4\ M_{0,c,pos}}{L_c - 0,1} \tag{2}$$

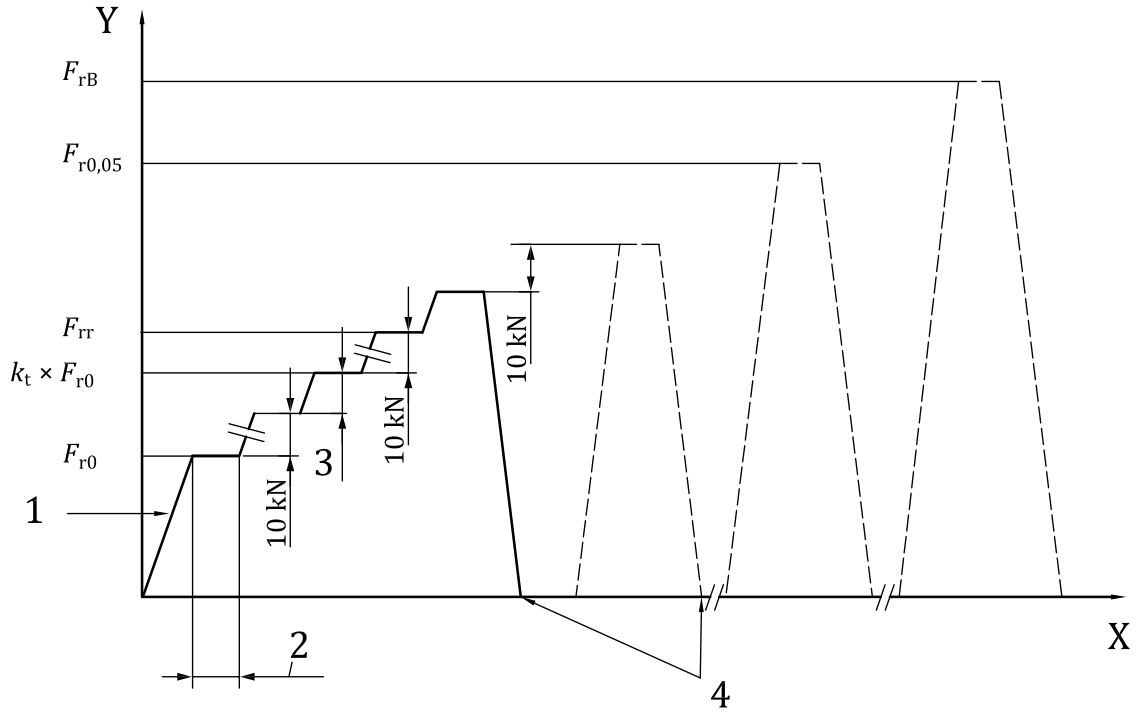
$$F_{c0n} = \frac{4\ M_{0,c,neg}}{L_c - 0,1} \tag{3}$$

NOTE For information on $M_{0,r,pos}$, $M_{0,c,pos}$ and $M_{0,c,neg}$, see ISO 22480-1:2022, 5.3.2 and 5.3.3

5.3.3 Static tests

5.3.3.1 Rail seat section

The static test procedures at the rail seat section with and without control of the residual cracks are shown in Figures 4 and 5.



Key

X	time
Y	load
1	120 kN/min maximum
2	crack inspection in loaded condition according to ISO 22480-1:2022, 9.2 (from 10 s minimum to 5 min maximum)
3	load step before $k_t \times F_{r0}$ smaller than or equal to 10 kN
4	crack inspection in unloaded condition according to ISO 22480-1:2022, 9.2 (maximum duration: 5 min)
———	required part of test
_ _ _ _	optional part of test

NOTE The optional part of the test is subject to modifications, if requested by the purchaser.

Figure 4 — Procedure for static positive bending test at the rail seat section with control of the residual cracks