

Design guidelines

Technical Specification – Sleepers, USPs and Fastenings

03-12-2024



Co-funded by
the European Union

*The sole responsibility of this publication lies with the author.
The European Union is not responsible for any use that may be made of the information contained therein.*

Table of Contents

1.	Scope	4
2.	Reference Documents	4
2.1.	The document hierarchy. Precedence in descending order shall be:.....	4
2.2.	Design Guidelines	4
2.3.	Technical Specification for Interoperability - TSI	5
2.4.	European Standards	Error! Bookmark not defined.
3.	Terms and definitions	6
4.	General requirements	7
4.1.	Sleepers	9
4.2.	Bearers	9
5.	Functional requirements.....	9
5.1.	Characteristic bending moments	9
5.1.1.	Sleepers	9
5.1.2.	Bearers	10
5.2.	Dimensions	11
6.	Materials	11
6.1.	General	11
6.2.	Concrete.....	12
6.2.1.	Aggregates.....	12
6.2.2.	Cement	13
6.2.3.	Concrete surface finish requirements	13
7.	Under Sleeper Pads	13
8.	Fastenings	14
9.	Quality System and Documentation	16
9.1.	Testing and acceptance	16
10.	Marking	17
11.	Storage and transportation.....	18
12.	Reliability, Availability, Maintainability and Safety (RAMS) requirements	Error! Bookmark not defined.
12.1.	Main concept	Error! Bookmark not defined.

12.2.	Safety requirements	Error! Bookmark not defined.
12.3.	Reliability, availability, and maintainability requirements	Error! Bookmark not defined.
13.	Warranty	Error! Bookmark not defined.

1. Scope

This Technical Specification describes the requirements of prestressed monobloc concrete sleepers and prestressed bearers to be supplied to Rail Baltica project. This set of requirements enables the producer of the sleepers and bearers to design and manufacture the sleepers and bearers that meet Rail Baltica project requirements. Requirements have been set to sleepers and bearers, fastening systems and under sleeper pads. Additionally, Quality Assurance and Quality Control (QA/QC) requirements have been established which are mandatory for the producer of the sleepers and bearers.

2. Reference Documents

2.1. The document hierarchy. Precedence in descending order shall be:

- a) TSI specification.
- b) Design Guidelines.
- c) Technical Specification.
- d) European Standards.
- e) UIC leaflets recommendations

Above mentioned standards and specifications are referred to in this specification (when revised or amended, subsequent revisions or amendments to these specifications shall apply).

2.2. Design Guidelines

The following Design Guidelines shall be applied and/or refer to:

Standard	Title
RBDG-MAN-012	Design Guidelines – General Requirements
RBDG-MAN-014	Design Guidelines – Railway Superstructure – Track
RBDG-MAN-032	Design Guidelines – RAMS targets
RBDG-MAN-033	Design Guidelines – BIM Manual

2.3. Technical Specification for Interoperability - TSI

Railways are to be based largely on national regulations and requirements. The purpose of the new European regulations is to standardize subsystems or components to reduce the cost of railways and to increase competitiveness, as well as to make it possible for trains to run between different member states without technical obstacles.

The following Technical Specifications for Interoperability (TSI) is based on best available expert knowledge and is related to the infrastructure subsystem of the rail in the European Union:

TSI	Title
Commission Regulation (EU) N° 1299/2014 of 18 November 2014 – Infrastructure TSI	Commission Regulation (EU) No 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union (hereinafter – TSI INF). Amended by: Commission Implementing Regulation (EU) 2019/776 of 16 May 2019 amending Commission Regulations (EU) No 321/2013, (EU) No 1299/2014, (EU) No 1301/2014, (EU) No 1302/2014, (EU) No 1303/2014 and (EU) 2016/919 and Commission Implementing Decision 2011/665/EU as regards the alignment with Directive (EU) 2016/797 of the European Parliament and of the Council and the implementation of specific objectives set out in Commission Delegated Decision (EU) 2017/1474.

2.4. European Standards

The relevant European standards used for high-speed lines and conventional lines are listed below:

Standard	Title
EN 13230	Railway applications – Track – Concrete sleepers and bearers
EN 13481	Railway applications – Track – Performance requirements for fastening system
EN 16730	Railway applications – Track – Concrete sleepers and bearers with under sleeper pads
EN 206	Concrete - Specification, performance, production, and conformity
EN 16431	Railway applications - Track - Hollow sleepers and bearers
EN 934-2	Admixtures for concrete, mortar, and grout - Part 2: Concrete admixtures - Definitions, requirements, conformity, marking and labelling
EN 12620	Aggregates for concrete
EN 13231	Railway applications - Track - Acceptance of works
EN ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories

EN 13674-1	Railway applications - Track - Rail - Part 1: Vignole railway rails 46 kg/m and above
EN 13146	Railway applications - Track - Test methods for fastening systems
EN ISO 9227	Corrosion tests in artificial atmospheres — Salt spray tests
EN ISO 4892-3	Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps.

3. Terms and definitions

Term	Definition
Sleeper	[Definition as per EN 13230-1 Ch.3]
Bearer	[Definition as per EN 13230-1 Ch.3]
Under sleeper pad (USP)	[Definition as per EN 16730 Ch.3]
Fastening system	[Definition as per EN 13481-1 Ch.3]
Notified Body (NoBo)	EU authorized body to carry out EC verification process of interoperability of railway systems and equipment.
Building information modeling (BIM)	a process supported by various tools, technologies and contracts involving the generation and management of digital representations of physical and functional characteristics of places.
Dynamic Testing	Verification and validation activity that provides final validation of the newly built railway infrastructure through a set of dynamic tests that completes the demonstration of integration between the reference rolling stock and the INF/CCS/ENE subsystems.
Bolted baseplate	A bolted baseplate fastening system is a rail fastening method where the rail is not directly secured to the sleeper, but secured to a steel baseplate, which then bolted to concrete sleeper or bearer.
The Client	The client is the organization (RBR or IBs) within the Rail Baltica Project in charge of the procurement of the sleepers.

4. General requirements

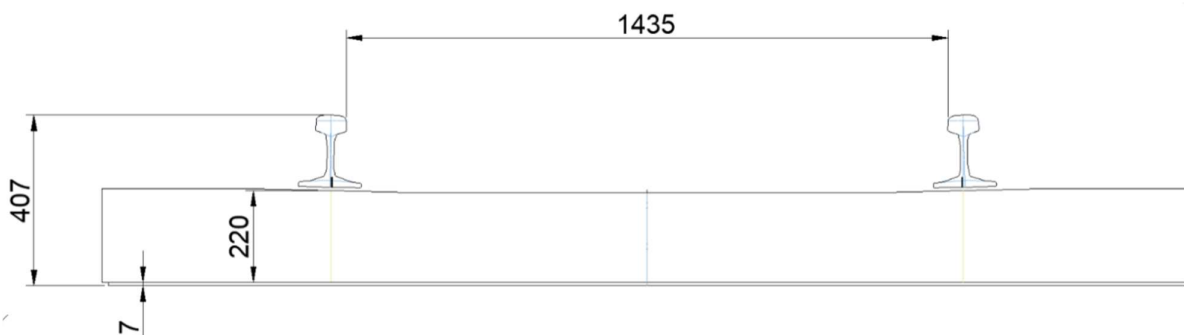
Sleepers, bearers, fastening systems and under sleeper pads to be supplied to Rail Baltica project The Client shall comply with the requirements described in this Technical Specification and European Commission Regulation No 1299/2014 (Technical Specifications of Interoperability – TSI). Nominal track gauge is 1435 mm and design track gauge for track sleepers is 1437 mm. The thickness and stiffness of all rail pads (plain line, turnouts, and Rail Expansion Joint - REJ) and Under Sleeper Pad (USP) are defined by Detailed Technical Design (DTD) designer (stiffness values shown in Table 1), in accordance to following criteria:

- a) Common overall construction height for entire Rail Baltica line,
- b) Quality of the ride,
- c) Operations,
- d) Maintenance,
- e) Capital Expenditure (CAPEX),
- f) Operating Expense (OPEX),
- g) Environmental conditions of Rail Baltica Project.

Required overall track stiffness is in the range of 70-80kN/mm. To reach these values, the supplier shall offer a suitable set of elastic components for the plain line based on values given in Table 1

The Client will review and approve the solutions proposed by turnout, REJs and sleeper suppliers which according to above mentioned requirements. The Client will analyze the implementation of one or other specific solution in conjunction with the above-mentioned characteristics (a-g).

Overall construction height throughout turnout integrated system, REJ and plain line shall be the same, to ensure consistent support on the ballast bed:



1. FIGURE 1 OVERALL CONSTRUCTION HEIGHT OF THE PLAIN LINE

Elements	Value, mm	Stiffness		Comments
		Track on embankment / cut, kN/mm	Track on structure, kN/mm	
Running rail 60E2	172	-	-	Fixed
Rail Pad	8*	70±15%	40±15%	*Recommended thickness to achieve overall construction height
Concrete Sleeper	220	-	-	Fixed
Under Sleeper Pad	7*	95	95	*Recommended thickness to achieve overall construction height
Overall Construction Height	407±5			Target

2. TABLE 1 PLAIN LINE

Stiffness values for bearers will be indicated in Technical Specification of Turnouts and REJ (RBDG-MAN-014D-0101_DG_TS_TurnoutsREJ)

The sleepers and bearers shall be supplied with fastenings, rail pads and under sleeper pads (USPs) fitted to the sleepers and bearers to form one element.

Lateral stability shall be in (Detailed Technical Design) designer calculated limits and shall withstand internal and external forces. The materials used for sleepers' and bearers' production shall fulfill the requirements described in EN 13230-1 Clause 5 and this Technical Specification.

The producer shall submit The Client all information stated in Clause 4.4.3 of EN 13230-1:2016.

Prior to supplying the sleepers and bearers, the producer must conduct Design Approval Testing on the sleepers and bearers in accordance with EN 13230-1 Clause 7. The producer shall submit Design Approval Testing Report to the The Client which shall confirm compliance with this Technical Specification.

The producer shall operate and maintain factory Quality System in accordance with EN 13230-1 Clause 8.

Sleepers and bearers for main line, expansion joints, turnouts, etc. shall be designed to withstand the load and speed conditions described in Table 1 throughout the Design Working Life of 50 years. Designing of the sleepers shall be done in accordance with EN 13230-6:2020 considering the worst loading condition described in Table 2.

Axle load, tons (t)	Speed, km/h
25 t	≤ 120
22,5 t	> 120 and ≤ 220
18 t	> 220 and ≤ 300

3. TABLE 2 RAIL BALTICA DESIGN AXLE LOADS AND OPERATIONAL SPEEDS

Rail Baltica tracks will be dynamical stabilized – sleepers with fastening system and under sleeper pad shall withstand stabilizing process without any damages.

4.1. Sleepers

The type of sleepers is prestressed concrete monoblock sleepers (EN 13230-2).

The sleepers shall be designed in accordance with EN 13230-6 and produced in accordance with EN 13230-1 and EN 13230-2, considering the requirements stated in this Technical Specification.

4.2. Bearers

The type of bearers is prestressed concrete bearers (EN 13230-4).

The bearers shall be designed in accordance with EN 13230-6 and produced in accordance with EN 13230-1 and EN 13230-4, taking into account the requirements stated in this Technical Specification.

5. Functional requirements

5.1. Characteristic bending moments

5.1.1. Sleepers

Sleepers shall be designed by the producer in accordance with EN 13230-6. Applicable characteristic bending moments with impact coefficients and test coefficients are described in Table 3.

The characteristic bending moments depend on the sleeper design and geometry. Factors stated in Table 4 shall be taken into account for designing the sleepers with length of 2600 mm. The input parameters stated in Table 4 shall be taken into account when designing the sleepers with other lengths.

Property	Symbol	Requirement
Positive characteristic bending moment at rail seat	$M_{k,r,pos}$	≥ 16 kNm
Positive characteristic bending moment at centre section	$M_{k,c,pos}$	$\geq 7,50$ kNm
Negative characteristic bending moment at centre section	$M_{k,c,neg}$	≥ -9 kNm
Negative characteristic bending moment at rail seat	$M_{k,r,neg}$	NR (shall be declared by the producer)
Static coefficient to be used for calculation of $Fr_{0,05}$ test load	k_{1s}	2,4

Property	Symbol	Requirement
Static coefficient to be used for calculation of $Fr_{0,5}$ or Fr_B test load	k_{2s}	3,3
Dynamic coefficient to be used for calculation of $Fr_{0,05}$ test load	k_{1d}	2,0
Dynamic coefficient to be used for calculation of $Fr_{0,5}$ or Fr_B test load	k_{2d}	2,9
Static coefficient to be used for calculating Fr_B at the end of fatigue test	k_3	3,3
Factor used for calculation of acceptance criteria for first crack formation in static test	k_t	$\geq 1,5$

4. TABLE 3. CHARACTERISTIC BENDING MOMENTS AND APPLICABLE COEFFICIENTS FOR SLEEPERS WITH LENGTH OF 2600 MM

Property	Symbol	Value
Nominal axle load	A_{nom}	221kN
Dynamic increment factor	k_v	0,75
Attenuation factor	k_p	1,0
Longitudinal load distribution factor	k_d	0,38
Support faults factor	k_r	1,35
	$k_{i,c}$	2
	$k_{i,r}$	1,6

5. TABLE 4. CHARACTERISTIC BENDING MOMENTS AND APPLICABLE COEFFICIENTS FOR SLEEPERS WITH LENGTH OF 2600 MM

5.1.2. Bearers

Bearers shall be designed by the producer in accordance with EN 13230-6.

Applicable characteristic bending moments and testing moments are described in Table 5.

Minimum length for bearers is 2600mm (except technically justified occasions)

Property	Symbol	Requirement
Positive characteristic bending moment	$M_{k,b,pos}$	22,50 kNm
Negative characteristic bending moment	$M_{k,b,neg}$	- 22,50 kNm
Positive testing bending moment	$M_{t,pos}$	32 kNm
Negative testing bending moment	$M_{t,neg}$	-30 kNm

6. TABLE 5. CHARACTERISTIC BENDING MOMENTS AND TESTING MOMENTS FOR BEARER DESIGN

Hollow Bearers:

- a) Concrete or Steel Hollow Bearers shall be designed by the Supplier in accordance with EN 13230-4, -6 and EN 16431:2014.
- b) Test methods are described in EN 16431:2014 section 5.

5.2. Dimensions

Rail profile is 60E2 as described in EN 13674-1:2011+A1:2017. Rail profile dimensions are described in Figure A.24 in the Annex A of EN 13674-1:2011+A1:2017.

Nominal track gauge is 1435 mm.

Rail inclination is 1:40.

Sleeper spacing of 600 mm (from center to center) shall be considered.

Sleepers shall be produced and supplied in accordance with the dimensions Table 6. Maximum allowable tolerances to other geometric properties shall be in accordance with EN 13230-1:2016 Table 1.

Property	Requirement
Overall length of the concrete element (L)	2600 mm
Minimum bottom width (b_1)	≥ 300 mm
Minimum top width (b_2)	170 mm
Maximum height at rail seat (h_p)	≤ 220 mm
Inclination of the rail seat	1:40
Minimum nominal weight of the sleeper (W_{nom}), incl. fastening system	$W_{min} \geq 300$ kg
Maximum weight of the sleeper incl. fastening system	$W_{max} \leq 360$ kg

7. TABLE 6. GENERAL GEOMETRIC PROPERTIES

6. Materials

6.1. General

The materials used for producing the sleepers and bearers shall be selected according to requirements stated in EN 13230-1:2016 Clause 5 and this Technical Specification. Special attention shall be paid to frost resistance of the concrete and resistance to alkali-silica reaction (ASR). To avoid ASR, one of the following conditions shall be met while deciding the final concrete mixture recipe:

- a) Limiting the total alkali content of the cement, stated as Na_2O equivalent to $\leq 0,60$ %, or;

- b) Limiting the total mass of reactive alkalis in the concrete to $\leq 3,0$ kg/m³. (ASTM C1260 – 14 or RILEM TC219-ACS: AAR-0, AR-1.1, AAR-2).

6.2. Concrete

Concrete used for sleeper and bearer production shall be produced in accordance with EN 206. The Assessment and Verification of Constancy of Performance (AVCP) level of the concrete production shall be 2+ (AVCP level 2+). Minimum concrete properties are described in Table 7.

Property	Value
Minimum compressive strength class	C50/60
Maximum water/cement ratio, in mass	0,45
Minimum cement content	300 kg/m ³
Resistance to freezing and thawing CEN/TS 12390-9	S56 $\leq 0,20$ kg/m ² or S56 $\leq 0,50$ kg/m ² if S56/S28 is ≤ 2
Porosity EN 13230-1 Annex C	V _p ≤ 12 %
Minimum compressive strength class	C50/60

8. TABLE 7. MINIMUM CONCRETE REQUIREMENTS

The Production of sleepers and bearers shall be done in accordance with EN 13230-1 Clause 6.2.

Aggregates used concrete production shall fulfill the requirements stated in Clause “Aggregates” of this Technical Specification.

Cement to be used for concrete production shall fulfill the requirements stated in Clause “Cement” of this Technical Specification.

Using admixtures for concrete production is only allowed in justified cases if it's agreed and accepted by The Client. The cost of using admixture(s) shall not be compensated by The Client. All admixtures shall conform to EN 934-2. Admixtures which are not within the scope of EN 934-2 shall conform to EN 934-1 general requirements.

Heat treatment is allowed if it complies with the requirements described in EN 13230-1 Clause 6.2.3 and the temperature is monitored and recorded during the curing process continuously.

Surface finish of the sleepers and bearers shall fulfill the requirements described in EN 13230-1 Clause 6.3 and Annex E.

6.2.1. Aggregates

Aggregates shall be produced in accordance with EN 12620. The Assessment and Verification of Constancy of Performance (AVCP) level of the aggregate production shall be 2+.

Producer shall provide the Client information which is described in EN 13230-1, Clause 5.3.

Aggregates shall fulfill at least F₂ frost resistance category (determined in accordance with EN 1367-1) and LA₃₅ (determined in accordance with EN 1097-2).

6.2.2. Cement

Cement used for producing the concrete for sleepers and bearers shall be produced in accordance with EN 197-1. The Assessment and Verification of Constancy of Performance (AVCP) level of the cement production shall be 1+.

Only CEM I cement may be used for concrete production.

Cement minimum strength-grade class shall be $\geq 42,5$.

Sulfur trioxide content of the cement % by mass shall be $\leq 4,0$ %.

6.2.3. Concrete surface finish requirements

Concrete surface finish shall be in accordance with EN 13230-1 Clause 6.3 and Annex E.

7. Under Sleeper Pads

The sleepers and bearers shall be equipped with elastoplastic Under Sleeper Pads (USPs) which shall be produced in accordance with EN 16730. Applicable track category is TC3.

Requirement for minimum service life 50 years or at least 600 MGT (Million Gross Tons) must be for all sleeper/bearer components. The qualification test plan for new product development must be approved by The Client, which shall include a USP fatigue test in accordance with EN 16730 and this technical specification. For an existing product, service life is confirmed by providing an EU railway USP product acceptance certificate, confirmation of installation on a like RB track and provided demonstration of service life at least 300 MGT additionally to fatigue durability requirement. No plan to replace USP during service life of sleeper/bearer.

The USP shall cover the entire bottom (base) area of the sleeper (i.e. including the center section). The distance from the edges of the bottom (base) of the sleeper shall be 15 ± 5 mm for width and 15 ± 10 mm for length dimensions.

Thickness of the USP without mounting mesh shall be 5 to 10 mm. Thickness shall be agreed with The Client before production. Production tolerance of the USP thickness shall be ± 1 mm.

Declared static bedding modulus (C_{stat}) value shall be within the range of $0,30 \text{ N/mm}^3 \leq C_{stat} \leq 0,40 \text{ N/mm}^3$. The static bedding modulus shall be assessed in accordance with EN 16730 Clause 5.3.2. Allowable tolerance compared with declared value is ± 20 %.

Declared low frequency dynamic bedding modulus ($C_{dyn,5Hz}$) of USP alone shall be within the range of $0,60 \text{ N/mm}^3 \leq C_{dyn,5Hz} \leq 0,70 \text{ N/mm}^3$. Allowable tolerance compared with declared value is ± 20 %.

Declared low frequency dynamic bedding modulus ($C_{dyn,10Hz}$) of USP alone shall be within the range of $0,60 \text{ N/mm}^3 \leq C_{dyn,10Hz} \leq 0,70 \text{ N/mm}^3$. Allowable tolerance compared with declared value is ± 20 %.

The tensile strength of the USP material shall be $\geq 2 \text{ N/mm}^2$.

The sleepers and bearers shall be stackable during the transportation and storage. Minimum allowable number of stacked sleepers shall be 15 and the maximum load shall be at least 0,8 N/mm².

USPs shall be embedded (not glued) onto the sleepers and bearers during the production phase. The USPs shall be equipped with suitable mounting system (e.g. mesh, etc.) to ensure strong and durable adhesion to the sleepers and bearers.

The average bonding (pull out) strength (σ_{av}) value between sleeper and USP shall be $\geq 0,50$ N/mm². Absolute minimum allowable bonding strength (σ_{min}) shall be $\geq 0,40$ N/mm². Pull out testing shall be carried out according to EN 16730 Clause 5.5.2.

- a) The durability of USP to fatigue shall be assessed according to EN 16730 Annex L and D (for existing product in service only D): After the testing, the USP shall not show any signs of perforation, cracking, or other damage.
- b) The mass of the sleeper shall not reduce more than 0,5%.
- c) The static and low frequency dynamic stiffness of USP shall not change by more than $\pm 20\%$

NOTE: In case of testing according to Annex D, the mass of sleeper requirement is not relevant.

The durability of USP to severe environmental conditions shall be assessed according to EN 16730 Annex N. Acceptance criteria is following:

- a) The static and low frequency dynamic stiffness of USP shall not change by more than -20% to +15%.
- b) Minimum bonding strength σ_{mv} shall be $\geq 0,40$ N/mm².

USP shall have excellent resistance to water (DIN 53428 or ISO 1817).

USP shall have good resistance to chemical agents (DIN 53428 or ISO 1817).

USP shall have class E resistance to fire (EN ISO 11925-2)

USP shall have good resistance to hydrocarbons (DIN 53428 or ISO 1817)

USP shall have excellent resistance to ozone (DIN 53428 or ISO 1431)

Water, Hydrocarbons, Ozone (in track) shall not significantly modify the material characteristics of USP. The test is performed in accordance with the Supplier's instructions which are approved by The Client.

8. Fastening system

Fastening systems for sleepers and bearers shall be produced in accordance with EN 13481-2. The fastening system category shall be C.

Sleepers, which are to be installed on viaducts longer than 30m and 40 m before on each direction, shall be additionally equipped with provisions and fastening system for guard rails installation. Distance between head of the guard rail and head of the closest rail shall be maintained between 0.360 m and 0.370 m. Top of guard rail level shall be aligned with top of rail level. Fastening system for guard rails: preferred the same as for running rails (inclination not required, vertical stiffness of rail support can be higher than for running rails), but other types can be proposed

with a justification. At the beginning and end of guard rails modified sleepers are required to form the “entry” into the guard rail channel. Design of “entry” will be specified by the The Client. All components of the fastening systems shall fit for their purposes.

Fastening system shall be equipped with system to avoid tilting/tipping.

Elastic fasteners and its’ components shall be protected against corrosion, either coated or galvanized.

The fastening system shall be easy to release and replace.

The fastening system shall ensure resilient pads are kept in place under the rail foot. The system shall provide the same stiffness performances during its design working life.

Only single type fastening system will be used in whole Rail Baltica railway line including turnouts, rail expansion joints, sleepers with additional provision for the guard rail and double gauge sleepers. There shall be possibility to install the same fastening system anywhere of above-mentioned specific places. Exceptions only for special clamping in justified cases with an approval from The Client. **Each** Fastening system shall allow at least following lateral and vertical adjustment:

Lateral adjustment ± 5 mm. This allows for a total lateral adjustment per sleeper of up to ± 10 mm for track gauge adjustment.

Bolted baseplates shall not be used on concrete sleepers.

Where bolted baseplates are required due to technically justified occasions (e.g., turnouts, expansion joints, etc.), female inserts in the concrete shall be used.

Fastening systems shall fulfill the requirements described in Table 8.

Property	Symbol	Requirement
Longitudinal rail restraint	EN 13481-2 Clause 5.1	≥ 9 kN ($V \geq 250$ km/h) ≥ 7 kN ($V < 250$ km/h)
Torsional resistance	EN 13481-2 Clause 5.2	Declared value
Rail pad static stiffness	EN 13481-2 Clause 5.4	[Values shown in Table 1]
Effect of repeated loading	EN 13481-2 Clause 5.5	Longitudinal rail restraint change ≤ 20 %. Vertical static stiffness change ≤ 25 %. Clamping force change ≤ 20 %.
Electrical resistance of fastening system and sleeper	EN 13481-2 Clause 5.6	≥ 5 k Ω c
Effect of exposure to severe environmental conditions	EN 13481-2 Clause 5.7	Following exposure to the salt spray test, the fastening assembly shall be capable of being dismantled without failure of any component and re-assembled using manual tools provided for this purpose
Dimensions	EN 13481-2 Clause 5.7	The overall dimensions shall be within the envelope shown in EN 13481-2 Figure 2. This requirement does not apply in case web support fastening system is used.

Property	Symbol	Requirement
Effect of fastening system tolerances on track gauge	EN 13481-2 Clause 5.9	Calculated to be within ± 1 mm
Clamping force (per clip)	EN 13481-2, Ch. 5.10	≥ 10 kN

9. TABLE 8. FASTENING SYSTEM REQUIREMENTS

9. Quality System and Documentation

EC declaration of conformity shall be submitted to The Client for all items and systems indicated in the European Commission Regulation No 1299/2014 (Technical Specifications of Interoperability – TSI).

The producer of sleepers and bearers shall implement and operate Quality System as described in EN 13230-1 Clause 8.

Prior to start of the production, the producer shall submit The Client a detailed overview of the production process and quality plan. Quality plan shall be aligned with EN 13230-1 Annex F.

The producer shall submit detailed drawings of the sleepers and bearers to The Client prior to delivery. All drawings shall be submitted both in “.dwg” and “.pdf” file formats. All drawings must be approved by The Client before production of the sleepers and bearers.

The producer shall submit Manufacturing Rules in accordance with EN 13230-2 Clause 5 (sleepers) and EN 13230-4 Clause 6 (bearers).

The producer shall maintain records of each order of sleepers. The records shall be retained by the producer for at least five years and must be available for inspection by The Client at any time. On request, this information shall be submitted to The Client. These records must include applicable material certificates and testing results for the following components:

- a) Aggregates
- b) Cement
- c) Admixtures (if any)
- d) Reinforcing steel
- e) Fastening systems
- f) Under Sleeper Pads

9.1. Testing and acceptance

Prior to proceeding with production, the sleepers and bearers are subjected to Design Approval Testing by the producer. The producer shall conduct Design Approval Testing according to EN 13230-1 and EN 13230-2 (sleepers) and EN 13230-4 (bearers). The testing shall include static, dynamic and fatigue testing of the sleepers and bearers,

including optional parts of the tests. The Client Test records from Design Approval Testing shall be provided to the Client and RBR prior to delivery. At the end of the acceptance process, a certificate of the product acceptance of sleeper will be issued. Requirements of certification will be provided by The Client. At the end of successfully completed development process including all testing and documentation the Product Acceptance certificate will be granted by The Client. The Product Acceptance certificate shall include only approved types. New products and components need product acceptance approval prior to installation in Rail Baltica track.

During the production phase, the producer shall organize routine testing of the sleepers and bearers in accordance with EN 13230-1 and EN 13230-2 (sleepers) and EN 13230-4 (bearers). These tests shall be done in the laboratories which are accredited in EN ISO/IEC 17025. The Client can initiate additional testing that shall be organized by the producer or The Client. Test records from routine testing shall be retained by the supplier but must be available for inspection by The Client at any time.

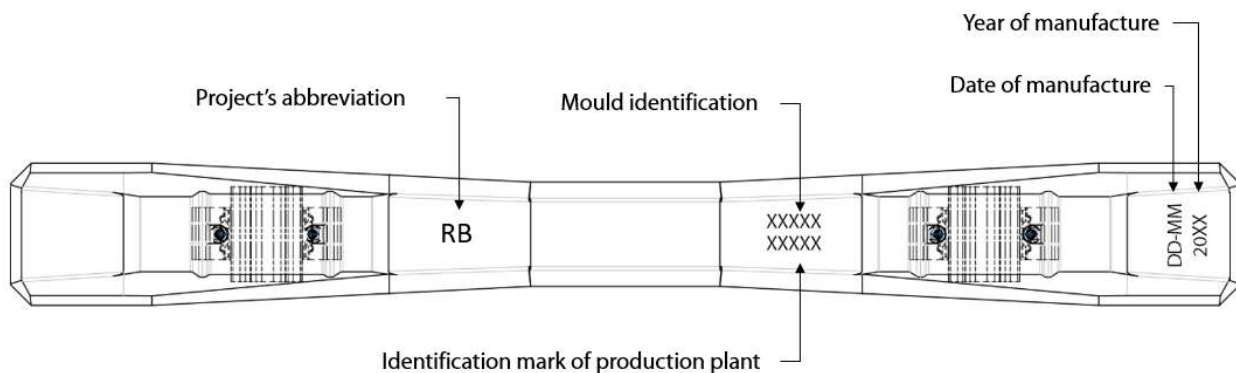
Up to 0,1% of the produced sleepers can be subjected to quality control by The Client (for destructive testing). The price of the sleepers to be subjected to testing shall be included in the tendering price. No additional costs will be carried by the The Client.

10. Marking

Each sleeper and bearer shall be marked in accordance with EN 13230-1 Clause 6.4. in addition to that on each sleeper shall be indicated manufacturing date and project's abbreviation. Design of project's abbreviation shall be agreed with a The Client prior start of production.

Besides the marking - position in a turnout or Rail Expansion Joint (REJ) shall be indicated for each bearer. For installation purposes weight in kgs shall be printed (not cast in concrete) on top of the bearer.

Information display on the sleeper as per Figure 2. For sleepers with additional provision for guard rails and for bearers of turnouts and REJ's information shall be displayed depending on available space and placement shall be agreed with a Client before start of production.



10. FIGURE 2 INFORMATION DISPLAY ON THE SLEEPER

11. Storage and transportation

Sleepers shall be stored and transported in such a manner that sleepers or fastening components are not damaged. The sleepers shall be stacked in such a manner as not to induce unacceptable stresses in the sleepers. Maximum number of layers for stacked sleepers shall be considered.

Sleepers shall be transported and stored horizontally with rail seat up. Rail fastening shall come from factory fully pre-assembled for rail installation on the sleeper.

If dowels are used for fastening system, the dowel holes must be open at the underside of the sleepers to allow eventual water to flow out from the dowel before freezing.

Sleepers with cast shoulders, if any, must be handled with extra care to protect the shoulders. During storage and transportation wooden shims with ≥ 50 mm thickness shall be used between the sleepers. After the installation of the sleepers the Supplier shall collect wooden shims from the IMF location.