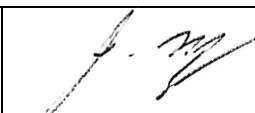





A Division of Transnet SOC Limited

SPECIFICATION
TECHNOLOGY MANAGEMENT
BBB2544 (Version 4)

SPECIFICATION FOR THE SUPPLY OF
SOLID WOODEN SLEEPERS
(BOULTON PROCESS OR AIR SEASONED)

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Date:			08 July 2020

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Table of Contents

Document version.....	3
1 Document scope.....	4
2 Reference Documentation.....	4
3 Definitions.....	5
4 General Requirements	7
5 Sleeper Requirements.....	8
6 Operating environment.....	8
7 Manufacture and Handling	9
8 Identification of Sleepers.....	13
9 Technical Requirements and Compliance.....	13
10 Moisture Content Determination.....	15
11 Dimensions and Tolerances.....	15
12 Quality inspection	16
13 Product Technical Approval and Continued Compliance	17
14 Documentation required from the bidder.....	18

Document version

Amendment number	Section amended	Summary of amendments	Date issued
1	ALL	Original specification updated (BBB2544, Version 2)	August 2006
2	ALL	Updated BBB2544, Version 3	October 2011
3	ALL	Updated to align with procurement procedures, minor technical revision, Version 4	July 2020

This document supersedes all documents with the same document number published prior to the date of publishing of this document. In addition, this document supersedes all documents relating to the manufacture and supply of solid wooden sleepers (Boulton process or air seasoned).

1 Document scope

This specification governs the supply of treated (creosoted) hardwood timber sleepers for use on railway tracks with a track gauge of 1065mm. Applications include but is not limited to:

- a) Open track;
- b) Bridges;
- c) and turnouts

2 Reference Documentation

A list of the referencing material; used to develop this standard; and that forms part of this specification is listed below, and may be referred to for further information.

- Manual for Track Maintenance, BBB0481, Latest version.
- South African Bureau of Standards (SANS) 870 (latest) - A borax-sodium pentachlorophenate mixture for anti-sapstain treatment of timber, or similar approved (in the case of air seasoning).
- South African Bureau of Standards (SANS) 1290 (latest) - Wood preserving mixtures of creosote and waxy oil, or similar approved (TYPE 1).
- South African Bureau of Standards SANS 10005 (latest) - Preservative treatment of timber.
- South African Bureau of Standards SANS 5984 - Moisture of timber (Oven dry method).
- South African Bureau of Standards SANS 5986 - Moisture of timber (Electric moisture meter method).
- American Wood Preservers Association (AWPA) C6 –99 – Crossties and switch ties – Preservative treatment by pressure process, where SABS specifications are not available.
- American Wood Preservers Association (AWPA) M2-01 – Standard for Inspection of wood products treated with preservatives, where SABS specifications are not available.

- American Wood Preservers Association (AWPA) M3-05 – Quality control for preserving plants, where SABS specifications are not available.
- American Wood Preservers Association (AWPA) M4-02 – Care of treated timber products, where SABS specifications are not available.
- American Railway Engineering and Maintenance-of-Way Association (AREMA) Part 3, where SABS specifications are not available.

3 Definitions

3.1 The timber related terms used in this specification are defined in the South African Bureau of Standards (SABS) 065 "Glossary of Timber Terms and Definitions" or similar publications such as the American Wood Preservers Association (AWPA).

3.2 The sleeper related terminology used in this specification is as follows:

3.2.1 Wooden sleeper:

- a. Track superstructure component used to hold the rails in position maintaining a specific gauge and rail inclination. Generally used as track sleeper (also referred to as open line sleepers or crossties) or crossing sleepers (also known as turnout sleepers or switch ties).
- b. Crossing sleepers are used to support turnout and crossing components.
- c. Track sleepers are used in tangent or curved track and are mostly used in sharp curved track where gauge widening is required.
- d. Bridge sleepers are used on steel decked bridges.

3.2.2 Rail seat area:

- a. For open line track sleepers, the rail seat area refers to the two areas on the timber sleeper that are in contact with the rail or the steel hardware that hold the rail in place. (Referred to as "potential rail chair bearing surfaces") (Refer to Appendix 1).
- b. For turnout and crossing sleepers, the rail seat area refers to the area starting 200mm from either end of the sleeper (Refer to Appendix 2).

3.2.3 Fibre saturation point:

The point at which water leaves the cell walls and shrinkage may become noticeable. It is generally species dependant and may range from a moisture content of between 25% and 45%. At this point or anywhere above it, timber is at its maximum volume.

3.2.4 Equilibrium moisture content:

The point at which the moisture content of wood remains constant for any given temperature and humidity. This feature varies from one climatic zone to another and may vary from as low as 8% in dry regions up to 15% in wet regions.

3.2.5 Expected lifespan:

The in-service life expectancy of a hardwood timber sleeper is the estimated duration during which the sleeper will maintain its strength and/or mechanical properties in order to perform its function. This period generally ranges from 15 to 20 years for turnout and crossing sleepers and 25 years for open line sleepers.

3.2.6 Cup:

Means curvature occurring in the transverse section of the sleeper. (Curvature over its shortest plane)

3.2.7 Bow:

Means curvature of the side faces of a sleeper in a plane parallel to the top and bottom faces.

3.2.8 Spring:

Means curvature of the top and bottom of the sleeper in a plane parallel to the side faces.

3.2.9 Wane:

Means the original rounded surface of a tree on a sleeper face and edge.

3.2.10 Knot:

- a. The typical rounded area visible on the surface of the sleepers after cutting it into a sleeper was formed during the life of the tree where the branches join the tree trunk
- b. Tight knot means a knot so held by growth that it can be relied upon to retain its position in the sleeper.
- c. Knot hole means a hole extending from face to face as a result of the absence of a knot or part of a knot.

3.2.11 Shake:

Means a partial or complete separation of the wood fibres along the grain in felled timber.

3.2.12 Twig warp:

Means twist showing lengthwise spiral distortion.

3.2.13 Gum pocket:

Means a cavity which contains or has contained an accumulation of gum.

3.2.14 Ingrown Bark:

Means bark in a flute or a pocket, or associated with a knot, which has been partially or wholly enclosed by the growth of the tree.

3.2.15 Split:

Means the separation of fibers parallel to the grain extending through the sleeper from one face to another.

3.2.16 Sleeper areas

End, face and edges of a wooden sleeper.

4 General Requirements

4.1 The permissible timber species are shown in appendix 3

- 4.2 This specification places the onus of conditioning and preserving the sleepers with the suppliers.
- 4.3 Sleepers will only be inspected after they have been conditioned & preserved prior to delivery.
- 4.4 Transnet reserves the right to reject any sleepers that do not conform to the requirements of this specification and to reject the whole batch if the inspection shows that >5% failed the inspection.

5 Sleeper Requirements

- 5.4 In the normal functioning of a track, a sleeper must retain the necessary strength properties over its expected lifespan.
- 5.5 These strength properties must provide the following:
 - 5.5.1 the necessary bending, shear and compressive strength to distribute the forces exerted from the rail into the track substructure.
 - 5.5.2 an effective bearing surface for fastening the rail to the sleeper to maintain the gauge and the required rail inclination.
 - 5.5.3 the necessary pull out strength to hold the coach screws in place.

6 Operating environment

- 6.4 The timber sleepers must be able to operate in an environment where the ambient temperatures range between -10°C and 50°C.
- 6.5 The timber sleeper will function under the following dynamic conditions:
 - a. Axle loading of up to 30 tons per axle
 - b. Traffic speeds of up to 100km/h
 - c. Applied wheel lateral loads of up to 60kN dynamic and 80 kN static
- 6.6 The expected life of the timber sleeper is 25 years, operating on rail lines with axle loads of 30 tons and 20 MGT per annum.

7 Manufacture and Handling

7.1 Pre- Manufacture Stage Requirements

- 7.1.1 The Supplier will ensure that the species proposed appears on the list of Permissible Species in Appendix 3.
- 7.1.2 The Supplier will state the species and the origin of the timber proposed for use as railway sleepers (Documentation required at Tender / Quotation Stage).
- 7.1.3 The supplier must be in a position to supply dry samples in Johannesburg of the timber species offered at the tender stage not smaller than 150mm x 100mm x 20mm. This must be done within a week from the official request.
- 7.1.4 If, more than one species is being offered, the Supplier will state the mix (composition) of the consignment (Documentation required at Tender Stage).
- 7.1.5 The species proposed shall be approved by the Regulatory Authorities (Environmental or other) in the country of origin; (proof required at time of inspection).
- 7.1.6 The supplier must provide an official document from the Department of Forestry (or an equivalent Government Department) from the country of origin, stating the harvesting management and forest revitalisation programs followed to prevent exploitation of the applicable species; (Documentation required at time of inspection).
- 7.1.7 The Supplier will take the necessary actions to ensure that the sleepers are manufactured from logs of good quality to provide sleepers complying with this specification.
- 7.1.8 The responsibility for ensuring compliance to dimensional tolerance specifications, deformation and defect tolerance limits following sawing and prior to further processing lies with the Supplier.

7.2 Manufacture Stage requirements

- 7.2.1 Sleeper species shall be restricted to hardwood type sleeper with acceptable species as listed in Appendix 3 with sleepers having a density greater than 800 kg/m³

- 7.2.2 Sapwood in sleepers shall be of compact wood throughout, where every inch of radius shall have 6 or more rings of annual growth.
- 7.2.3 The Supplier must take the necessary actions to prevent insect infestation and fungal attack during manufacturing of the sleepers.
- 7.2.4 Any treatment must comply with health regulations in the location of treatment.
- 7.2.5 Sleepers must be batched in groups, according to types, source and date of felling.
- 7.2.6 Sleepers are to be marked to ensure that batching is correct and to facilitate traceability and correlation with supplier records (Documentation to be available on request).

7.3 Incising

- 7.3.1 Incising is highly recommended on an approved incising machine to allow excess moisture to escape, to reduce splitting, surface checking and shakes, accelerate seasoning and ease of creosote penetration.
- 7.3.2 Incising shall be carried out immediately after sawing and before seasoning.
- 7.3.3 Depths of incising shall not exceed 20mm on all faces and sides using an approved, incising technique (AREA Manual for Railway Engineering) (SANS 10005).
- 7.3.4 Bidders must indicate if they intend incising and if incising details of incising machines including shape and spacing of incising teeth must be supplied.
- 7.3.5 Transnet will purchase of sleepers not incised, if sufficient penetration of creosote did take place and if the moisture content is below 25%.

7.4 Anti – Splitting Devices

- 7.4.1 Anti – splitting devices shall be used for all sleepers as prescribed by the AREMA Manual for Railway Engineering paragraph 3.1.6 or
- 7.4.2 Anti – splitting devices shall be restricted to the use of Nail–Plates for end-plating.
- 7.4.3 A nail plate shall
 - a. be made of high tensile steel.

- b. have a zinc coating that complies with the requirements of SANS 3575.
- c. be of a thickness of at least 1,2mm and a punched length of at least 14mm.
- d. be of such a size that the area covered by the nail plate is at least 80% of the area of the sleeper end.

7.4.4 Securing of nail plates:

- a. Various methods of securing a nail plate may be used, but each nail shall be fully embedded in the sleeper end and no nail shall be bent.
- b. The nail plate shall be so positioned on the sleeper end that its edges do not protrude over the sleeper end.
- c. Joining of nail plates will not be allowed on a sleeper end.

7.4.5 Other acceptable anti-splitting devices will be the bolt.

- a. To prevent splitting at the sleeper ends, a M12 grade 8.8 bolts and nuts can be used with 50mm x 3mm thick round or square washers on both sleeper edges.
- b. Bolts shall be placed approximately 150mm from the sleeper end and in the middle of the sleeper edges.

7.4.6 Unacceptable anti-splitting devices will be the C-hooks, S-hooks, Z-hooks or similar devices hammered into the sleeper ends.

7.4.7 Tenderers shall submit details of their proposed anti-splitting device with their tenders.

7.5 Wood Preserving

7.5.1 All wood preserving shall be according to the AREMA specification, Part 6, or SANS 870 (Latest), SANS 1290 (latest) Type 1, SANS 10005 (latest) or AWPAC C6-99.

7.5.2 The Boulton Drying Method shall be the preferred method used to facilitate accelerated drying.

7.5.3 Moisture content of timber shall be reduced to at least 25% before preservative treatment.

7.5.4 Stickers (min 25mm thick) must be used between sleepers when preserving.

7.5.5 Penetration shall be effected to 90% in all sapwood growing rings.

7.5.6 Retention of preservative shall be at least 112 kg/m³ or up to refusal.

7.5.7 Impregnation details must be recorded in the form of a certificate and must include the following:

- a. date of impregnation
- b. batch number and number of sleepers in batch
- c. type of preservative used
- d. Quantity of preservative retained in kg/m³.

7.6 Handling stage requirements

7.6.1 Sleepers will be stacked and secured in bundles of equal length.

7.6.2 Sleepers approved for shipping shall be handled such that minimum damage occurs during the process of transportation.

7.6.3 Sleepers approved for shipping shall be loaded into:

- a. When shipped per sea vessel:
 - I. Flat rack containers with collapsible ends
 - II. Container loads shall be in stacks, adequately arranged and strapped with steel strapping, to avoid movement and subsequent damage
 - III. Stacks shall be arranged such that it is easy to offload with a forklift
 - IV. The maximum weight of a container shall be 19 metric tonne, to comply with the South African road ordinance weight restrictions
- b. When shipped by rail or road :
 - I. Loading shall be in stacks, adequately arranged and strapped with steel strapping, to avoid movement and subsequent damage
 - II. Stacks shall be arranged such that it is easy to offload with a forklift

8 Identification of Sleepers

- 8.1 Marking of sleepers must be done in such a manner that adequate reconciliation can be done between supplier test records and sleepers.
- 8.2 The supplier shall attach to each sleeper a durable marking disk bearing his
 - a. trade mark.
 - b. species mark.
 - c. year of manufacture and.
 - d. reference mark.
- 8.3 The disc shall be attached in the sleeper at the centre of the sleeper face, 100mm from the sleeper end.
- 8.4 The marking disc shall be of aluminium alloy or similar approved with a diameter of between 30 and 40 mm. It shall be domed to between 4 and 7 mm in the middle and not less than 1 mm thick.
- 8.5 When attached to a sleeper a hole of 5 mm maximum depth shall be drilled to allow tight fit of the disc. After fitting the disc, it shall be knocked flat with a suitable hammer without hurting the marking, to form a non-removable fit. The disc shall not stand proud of the sleeper face.
- 8.6 Markings should be such that it is clearly legible after preservation treatment and not easily damaged or removed during the handling process.

9 Technical Requirements and Compliance

- 9.1 The sleeper will be unsuitable for its intended use when, in the opinion of the laboratory personnel:
 - a. Any sleeper which, in the opinion of the laboratory personnel, is not sound and/or or damaged and/or rotten and/or infested by any form of plant organism and/or animal/ insect attack or in any other respect not specifically mentioned in the specification, to such an extent that the sleeper is unlikely to retain the necessary strength and/or mechanical properties for an expected lifespan, will be rejected.

- b. it will, for the duration of its expected lifespan, not have the necessary ability to withstand weathering and/or not retain the necessary strength or mechanical properties for its use, due to its condition and/or its preservative treatment absorption and retention properties.
- c. do not comply with this specification

9.2 The sleeper shall be free from the following:

- a. pith.
- b. attack by plant organisms.
- c. attack by animals or insects.
- d. any form of fracture (brittle, cross or splinter).
- e. any form of defect occurring before conversion (knot, shake, gum or bark pocket or any variation or combination of these defects).
- f. any defect occurring after conversion i.e. seasoning (checks, bow, cup, twig warp or any variation or combination of these defects).
- g. signs of lightning damage.

9.3 The sleeper shall be free from wane exceeding the limits specified in:

- a. Appendix 1 - open lines and on bridges
- b. and Appendix 2 - crossing sleepers.

9.4 Visually unacceptable sleeper condition

The following visual defects will not be acceptable:

- a. Separation of fibres caused by shakes, ring shakes, shell shakes, heart shakes, felling shakes, splits, cracks or any other separation caused before conversion, during manufacture or while drying.
- b. Tight knots not to exceed 50mm measured across the maximum diameter of the knot.
- c. Knot hole, loose knot or dead knot not to exceed 30mm measured across the maximum diameter.
- d. No ingrown bark, gum pockets.

- e. The AREMA specification shall also apply to all visible defects including but not limited to the following: wane, knots, shake, split, checks, slope of grain, bark seams, bow and cup.

10 Moisture Content Determination

- 10.1 The supplier must conduct his own moisture content tests as part of their quality control and manufacturing process and maintain records thereof. Records must be supplied to Transnet on request.
- 10.2 Transnet as part of the approval of the batches will do moisture measurements to determine if a batch complies with the specification.
- 10.3 The moisture content can be determined by:
 - a. the Oven-dry method according to SANS 5984 or AWP A M2-01 or
 - b. The electric moisture-meter method according to SANS 5986 or AWP A M2-01 or
 - c. As per Transnet's standard test method Field inspection and hand measurement for timber sleepers (TQM-TRL-STM-6)
- 10.4 Measurements must be made at least 300mm from the end of the sleeper avoiding knots, sapwood and pith. The arithmetic mean of all the readings on a sleeper will be the moisture content of the sleeper.

11 Dimensions and Tolerances

The dimensions and tolerances for all timber sleepers are given in Table 1.

- 11.1 All sleeper ends will be square (90°) to all surfaces and all surfaces perpendicular to each other.
- 11.2 Cup across the width or depth shall not exceed 3mm measured using a straight edge placed across the face/ edge.
- 11.3 Bow shall not exceed 25 mm for the 2100 mm sleepers and 10 mm per metre for all other sleepers with a maximum limit of 40 mm when measured from end to end.

11.4 Spring shall not exceed 40mm measured in a straight line.

Table 1: Sleeper dimension tolerances

	Open Track		Crossing/ Switches		Bridge	
	Dimensions (mm)	Tolerances (mm)	Dimensions (mm)	Tolerances (mm)	Dimensions (mm)	Tolerances (mm)
Width	250	+40 & -10	250	+40 & -10	250	+40 & -10
Thickness	125	+10 & -10	125/150	+10 & -10	125	+2 & -2
Length	2100	+75 & -25	2100	+75 & -25	2100	+75 & -25
			2400			
			2700			
			3000			
			3400			
			3800			
			4200			
			6000			

12 Quality inspection

12.1 All timber batches are subject a quality inspection by Transnet.

12.2 Responsible person(s)

- a. Transnet's Track Technology department will be responsible for checking the quality of the sleepers or
- b. A representative officially appointed by Transnet Freight Rail to act on their behalf

12.3 All quality related documentation shall be available at the time of inspection.

12.4 Inspections

- 12.4.1 Inspections are to be conducted once sleepers have been fully processed prior to loading and shipping.

- 12.4.2 The inspection will be performed as per Transnet's standard test method Field inspection and hand measurement for timber sleepers (TQM-TRL-STM-6)
 - 12.4.3 Sampling will be done in accordance with Track Technology Managements Quality Management System procedure for Sampling (TQM-TRL-PRO-5).
 - 12.4.4 Transnet reserve the right to sample up to 25% of each batch.
 - 12.4.5 The laboratory personnel shall mark and record all sleepers accepted for delivery.
 - 12.4.6 The supplier must supply resources to assist in the handling and measuring of sleepers during such inspection
 - 12.4.7 Prior to the inspection the sleepers must be spread open to:
 - a. allow access to the sleepers
 - b. allow sleepers to be turned
 - c. allow for the inspection of all surfaces
 - 12.4.8 The supplier on request must prepare holes in the timber sleepers to a depth of up to, but not exceeding 15mm as requested by the laboratory personnel to assess depths of penetration.
 - 12.4.9 Inspection holes shall be filled with preservative and plugged with hardwood plugs which have undergone the same preservative treatment as the sleepers once inspection has been conducted.
 - 12.4.10 The certificates of impregnation for each batch must be available
- 12.5 The decision of the laboratory personnel to accept or reject sleepers shall be final.

13 Product Technical Approval and Continued Compliance

- 13.1 Product approval is based on a fixed list of species as per Appendix 3.
- 13.2 All products must be approved for use in Transnet by Track Technology Management and such approval includes field evaluation of all batches.

13.3 Transnet may in the future expand the list of species based on testing (outside of the scope of this specification).

13.4 Continued compliance is checked by inspecting each batch against this specification.

14 Documentation required from the bidder

14.4 Procurement Stage

- a. Completed Questionnaire(s)
- b. Details of species offered
- c. If applicable, the % split between species, and origin
- d. Proof of sustainable harvesting
- e. Proof of harvesting the species
- f. If applicable, incising details
- g. Intended anti-splitting device

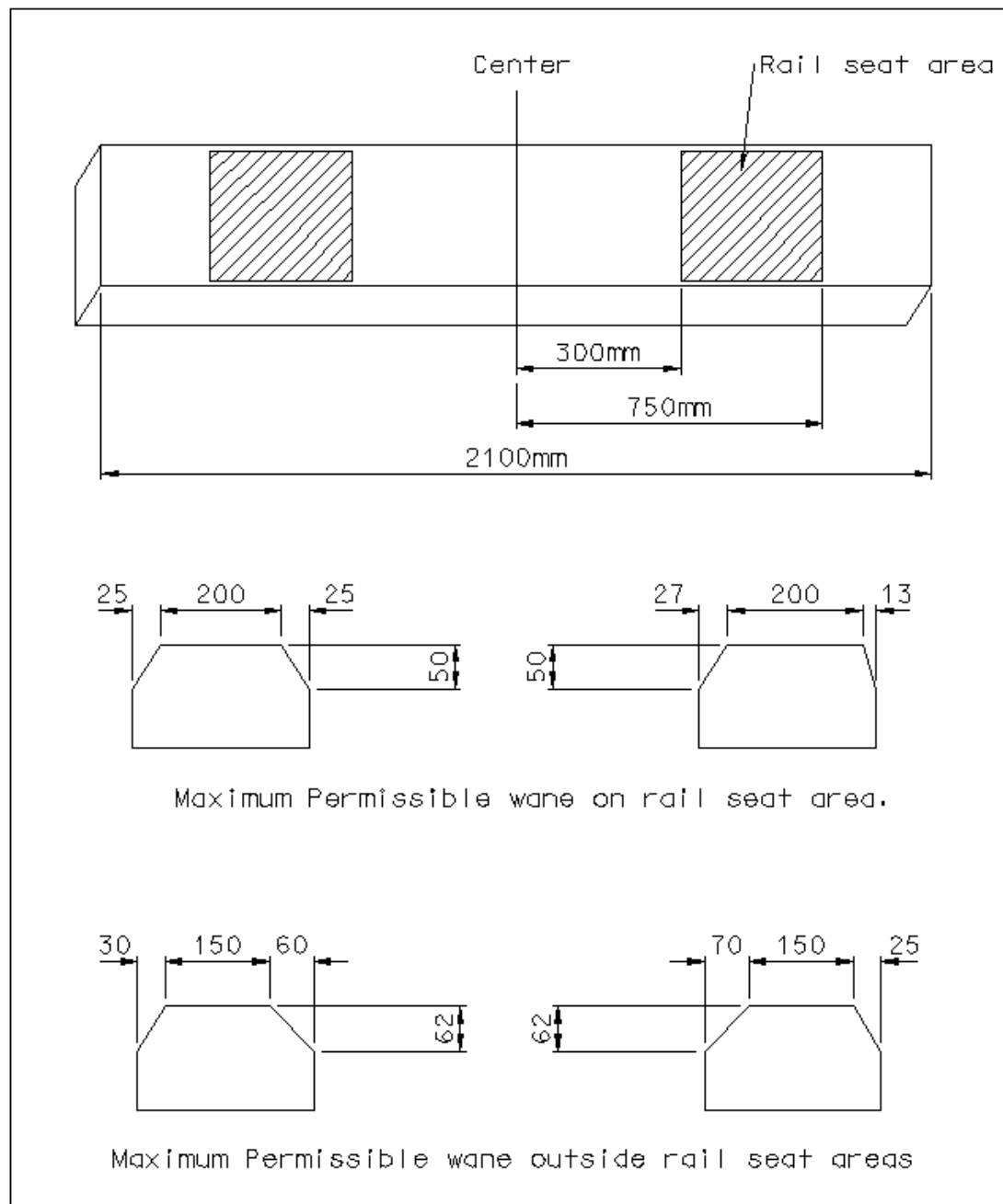
14.5 Inspection stage

- a. Quality-related documents, including moisture content results
- b. Impregnation certificate
- c. Species
- d. Number of sleepers available for inspection
- e. Stacking and site layout details

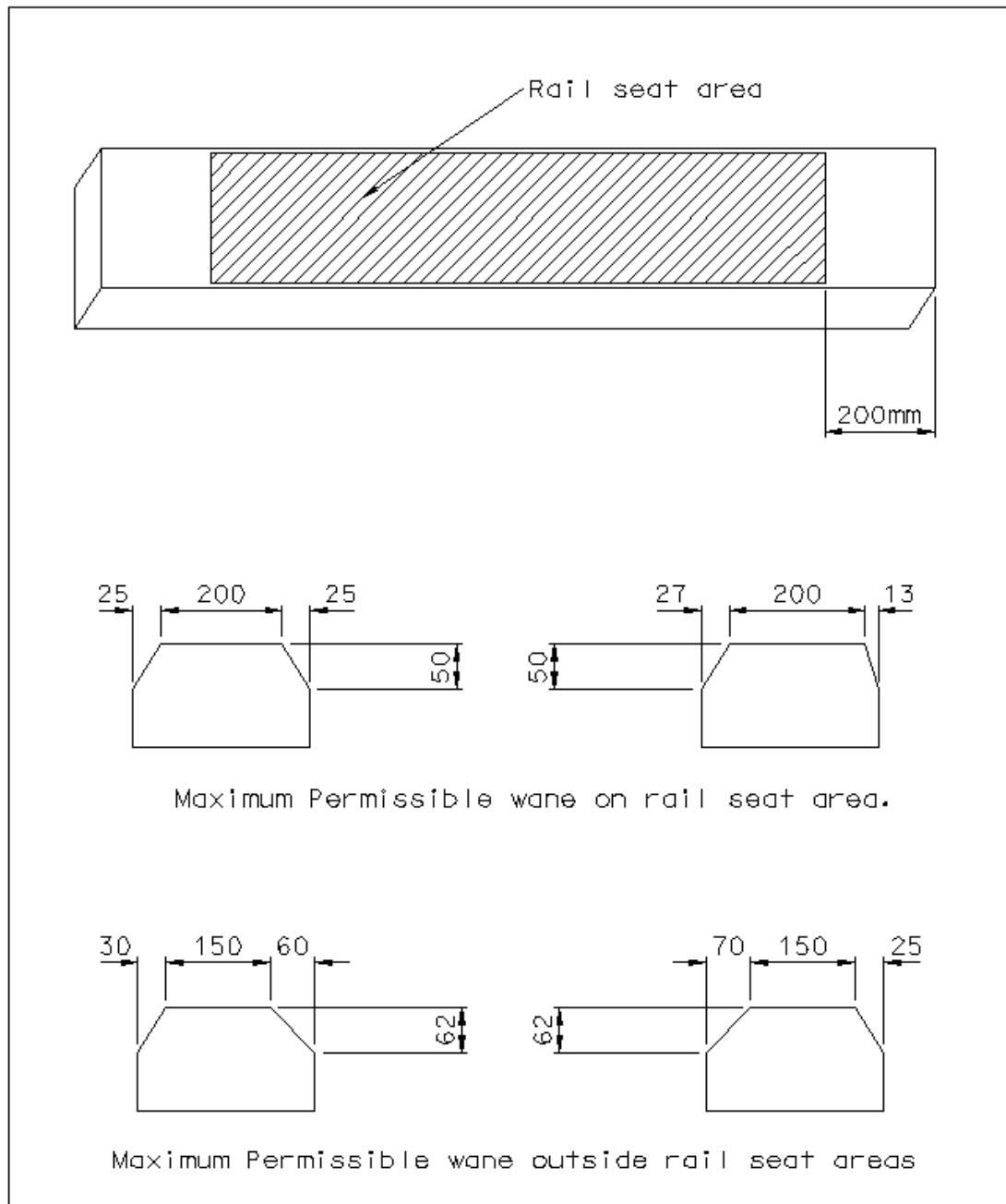
14.6 On delivery

- a. A letter of compliance that indicate that sleepers comply with this specification
- b. A report issued by Transnet recording result of inspections.

Appendix 1: Open Line Sleepers including bridge sleepers



Appendix 2 : Crossing Sleepers



Appendix 3: Permissible Species

Botanical Name	Common Name	Marking	Origin
<i>Acacia uigrescens</i>	Micaia, Knob Thorn	AN	Africa
<i>Acer rubrum</i>	Red Maple	AR	United States
<i>Acer saccharum</i>	Sugar Maple	AH	United States
<i>Afzelia bipindensis</i>	Coussie	AA	Africa
<i>Afzelia pachyloba</i>	PaPa	AA	Africa
<i>Amblygonocarpus andongensis</i>	Banga Wanga, Scotsman's Rattle	AA3	Africa
<i>Amblygonocarpus andongensis</i>	Mutiria Maruldao	AO	Africa
<i>Androstachys johnsonii</i>	Mecrusse, Umzimbiti, Lebombo Ironwood	AJ3	Africa
<i>Aspidosperma quebracho</i>	White Quebracho	AQZ	S. America
<i>Baikiaea plurijuga</i>	Rhodesian Teak	BP2	Africa
<i>Baillonella toxisperma</i>	Moabi	BT3	Africa
<i>Betula alleghaniensis</i>	Yellow Birch	YB	United States
<i>Brachystegia spiciformis</i>	Messasa	BS5	Africa
<i>Carya cordiformis</i>	Bitternut Hickory	BH	United States
<i>Carya ovata</i>	Shagbark Hickory	CV	United States
<i>Celtis occidentalis</i>	Hackberry	CO	United States
<i>Cordyla madagascariensis</i>	Anakaraka	CM3	Malagasy

Botanical Name	Common Name	Marking	Origin
<i>Cynometra alexandrii</i>	Muhimbi	CA3	Africa
<i>Dialium englerianum</i>	Ntiele	DE3	Africa
<i>Erythrophleum</i> spp	Messanda, Missanda, Muave Kassa Eloun, Tali	ES	Africa
<i>Fagus grandifolia</i>	American Beech	FG	United States
<i>Fraxinus Americana</i>	White Ash	FA	United States
<i>Fraxinus pennsylvanica</i>	Green Ash	FP	United States
<i>Gilbertiodendron dewevrei</i>	Ditshipi, Limbali	MD1	Africa
<i>Gleditsia triacanthos</i>	Honeylocust	GT	United States
<i>Guibourtia colesperma</i>	Rhodesian Copalwood, Bastard Mopane	GC3	Africa
<i>Guibourtia conjugata</i>	Chacate	GC	Africa
<i>Juglans nigra</i>	Black Walnut	JN	United States
<i>Lophira alata varprocera</i>	Ekki, Bongossi	LA3	Africa
<i>Millettia stuhlmanni</i>	Panga-Panga	MS2	Africa
<i>Morus mesozygia</i>	Mercodze, African Mulberry	MM2	Africa
<i>Perinari excelsa</i>	Mbula	PE2	Africa
<i>Quercus alba</i>	White oak	WA	United States
<i>Quercus borealis</i>	Northern red oak	QB	United States
<i>Quercus falcate</i>	Southern red oak	QF	United States
<i>Quercus stellata</i>	Post Oak	QS	United States
<i>Quercus velutina</i>	Black Oak	QV	United States

Botanical Name	Common Name	Marking	Origin
<i>Quercus velutina</i>	Black Oak	QV	United States
<i>Robinia pseudoacacia</i>	Black Locust	RP	United States
<i>Sassafras albidum</i>	Sassafras	SA	United States
<i>Schinopsis</i> spp	Red Quebracho	SC2	S. America
<i>Shorea</i> spp	Red meranti	SS3	East Indies
<i>Shorea</i> spp	Balau Group	SS4	Asia
<i>Staudtia stipitata</i>	Niove	ST3	Africa
<i>Swartzia madagascariensis</i>	Missimbe, PauFerro, Snake Bean	SM2	Malagasy
<i>Ulmus thomasi</i>	Rock Elm	UT	United States
<i>Xylia dolabriformis</i>	Pyinkado	XD	Asia