

TECHNICAL SPECIFICATIONS

RAILWAY SLEEPERS AND CIVIL WORKS TIMBERS



1. RAILWAY CROSSTIES

COMMON CREOSOTE TREATED RAILWAY CROSSTIES- AREMA GRADE 5 / AWPA U1C – T1C



GENERAL CHARACTERISTICS

Hard wood (broad-leaved) with great physical and mechanical properties, from E4 group or above (NCh1989.Of86), preserved and waterproofed under vacuum and pressure with distilled oil coal tar creosote, suitable to withstand burdens and workloads of a railway under conditions of direct exposure to sun, rain and soil moisture. On well-maintained ballast roads, in temperate and rainy climates the average durability is equal or greater than 30 years.

USE AND APPLICATIONS

Railway wooden crossties are used for railroad tracks of low, medium, high and very high tonnage; easily supporting weights of up to 32 tons per axle, with operating speeds of up to 120 km / h on freight trains and 175 km / h on passenger trains and a density of traffic that can exceed 100 million gross tons per year at any specific point of the rail network. Especially indicated for conditions where drainage problems exist such as: ballast scarcity, ballast clogged with mud and water, and unstable platforms, with plastic sate soils of low supporting capacity. They adapt to different types of rails and / or fixations and to the broadening of the gauge in curves of any radius. Wooden Sleepers are also very resistant to impacts caused by derailments and easy installation with any kind of machinery, even those for manual use.

These crossties are present in high density traffic, surface and underground such as: mining railways, subway and urban trains, trams; in medium and long distance travel trains, both in Chile and in South America, North America, South Africa, Middle East and Asia-Pacific.

WOOD SPECIES

- Chilean Oak (*Nothofagus obliqua*)
- Chilean Beech (*Nothofagus dombeyi*)

PROCESS OF CHEMICAL PRESERVATION OF WOOD

The wood is dried and sterilized in an autoclave chamber by vacuum (-10psi) and high temperature (180 ° F) for a period of 24 to 30 hours and then, inside the same chamber at the same temperature, a waterproofing, fungicide and insecticide mixture composed of distilled creosote oil of coal tar (60%) and heavy oil, Fuel Oil No. 5 (40%) is injected under pressure (200psi). This mixture replaces water extracted from wood at an average depth of 16mm, sufficient to isolate the wood from decay caused by fungi, insects and bacteria. The waterproofing seal also gives wood dimensional stability due to its control of the exchange of humidity with the environment. The quality of the wood and the impregnation process are in accordance with the specifications of the AREMA Engineering Manual (American Railway Engineering and Maintenance - of - Ways Association) and the AWPA (American Wood Protection Association) standards above mentioned.

PHYSICAL AND CHEMICAL PROPERTIES

❖	Wood	$930 \frac{kg}{m^3}$ (87,74%)
❖	Fuel Oil N°5	$52 \frac{kg}{m^3}$ (4,91%)
❖	Creosote	$78 \frac{kg}{m^3}$ (7,36%)
❖	Moisture content	50%
❖	Preservative solution retention	$130 \frac{kg}{m^3}$
❖	Average penetration	16 mm
❖	Density at state of use (reference value)	$1060 \frac{kg}{m^3}$
❖	Density at 12% of moisture content	$615 \frac{kg}{m^3}$

NAME	SCIENTIFIC NAME	DENSITY at 12% MOISTURE CONTENT $\frac{Kg}{m^3}$	TENSILE STRENGTH AT 12% MOISTURE CONTENT					
			COMPRESSION PERPENDICULAR TO GRAIN AT 5% PROP. LIMIT $\frac{Kgf}{cm^2}$	COMPRESSION PARALLEL TO GRAIN $\frac{Kgf}{cm^2}$	SHEAR $\frac{Kgf}{cm^2}$	JANKA SIDE HARDNESS Kgf	STATIC BENDING	
							MOE $\frac{Tonf}{cm^2}$	MOR $\frac{Kgf}{cm^2}$
CHILEAN BEECH	<i>Nothofagus dombeyi</i>	604	92	453	126	491	106	776
CHILEAN OAK	<i>Nothofagus obliqua</i>	624	70	476	120	465	124	837

Sources: *Manual de Cálculo de Construcciones en Madera Nº13 / Wood Construction Manual Nº13, INFOR, Santiago, 1980.*
Chilean Official Standard Nch1989.Of86. Agrupamiento de especies madereras según su resistencia- Procedimiento
Wood Handbook- Wood as an engineering material, USDA, Forest Service, Forest Products Laboratory, Madison, Wisconsin 2010.

NAME	SCIENTIFIC NAME	SLEEPER DIMENSION	MOISTURE CONTENT (%)	SAMPLE DENSITY $\frac{Kg}{m^3}$	ADMISIBLE TENSILE STRENGTH	
					COMPRESSION PERPENDICULAR TO GRAIN $\frac{Kgf}{cm^2}$	SCREW SPIKE EXTRACTION Nº5 Kgf
CHILEAN BEECH	<i>Nothofagus dombeyi</i>	2 750mm x 250mm x 150mm	96.35%	955	81	5617
CHILEAN OAK	<i>Nothofagus obliqua</i>	2 750mm x 250mm x 150mm	20.35%	704	116	6012
CHILEAN BEECH	<i>Nothofagus dombeyi</i>	2 600mm x 240mm x 170mm	22.00%	779	82	6220
CHILEAN OAK	<i>Nothofagus obliqua</i>	2 600mm x 240mm x 170mm	54.00%	844	38	4210

Sources: *Technical Report Nº 2003 – 26 Material Investigation Report Engineering Department Universidad de Santiago de Chile*
Technical Report Nº 2004 – 58 Material Investigation Report Engineering Department Universidad de Santiago de Chile
Manual de Cálculo de Construcciones en Madera Nº13 / Wood Construction Manual Nº13, INFOR, Santiago, 1980.
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DIMENSIONS

- 2 750mm x 250mm x 150mm
- 2 600mm x 240mm x 170mm

HANDLING INDICATIONS

The crosstie must be handled in accordance with the instructions in the Product Safety Sheet. In general terms, PVC gloves, PVC shirt, safety footwear and helmet should always be used, sleepers are heavy elements with a slippery surface. They can be handled in a mechanized or manual way, in which case the joint action of two people and the use of a lumbar belt are recommended. No cutting or trimming should be done; it removes the waterproofing cover. Pointy elements that penetrate the wood and break the waterproof seal must not be used. Skin contact with the preservative solution should be avoided; creosote usually does not run off, but when handling, it stains and in direct contact with the skin can cause allergy.

DISPOSAL OF EXCLUDED MATERIAL

The excluded material must not be incinerated in domestic stoves. It can only be done in high temperature furnaces authorized for the incineration of hydrocarbons. It can be used for any structural use where it is not exposed to the interior of buildings for residential use. It can be used as a containment element, machinery floor, and agricultural use as long as it is not part of food containers or drinking water of domestic animals.

According to the standard NCh382: 2013, it is not a hazardous waste.

HEALTH AND ENVIRONMENT PROTECTION STANDARD

The application of vacuum and pressure treatment of wood using creosote as wood preservative for rail, road, port and electrical use is approved both in North America through the registration EPA - Case 0139 (363 - 1468 - 61483 and 73408) and in the European Union with the registry EN 13991-2003. In Chile, the official Chilean standards NCh790.Of2010 and NCh189: 2012 are those that specify the application in vacuum and pressure treatment of creosote as a wood preservative.

Creosote treated wood contains mostly wood (87.74% of the mass) injected with a mixture of waterproofing oils and pesticides (Creosote and Fuel Oil No. 5), known generically as "Creosote" (12.26% of the mass). The creosote forms a very stable union with woody material due to the high cohesion and adhesion forces reached during the pressurization process and the kinematic viscosity (4-14mm² / s) of the preservative fluid (creosote + petroleum); factors that allow it to reach high surface tensions inside the vessels that contain it, considering that the diameters in broadleaved-wood (hardwood) such as oak or beech, normally reach 50 - 100 micrometers (0.05 - 0.1mm), which makes the draining of the preservative minimal. In the applications indicated is acceptable and safe for human health, animals and also for the protection of the environment according to the aforementioned regulations.