NORTH AMERICAN WOOD POLE COUNCIL

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TECHNICAL BULLETIN

Wood Utility Pole Design Values in the NESC

Prepared by:

North American Wood Pole Council

Wood Utility Pole Design Values in the National Electrical Safety Code (NESC)

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Introduction

In the 2022 edition of ANSI O5.1 - ***Wood Poles, Specifications and Dimensions***, Modulus of Elasticity (MOE) values were added to the table of fiber strength values to provide a single source for such data for wood utility pole designers.

The Modulus of Elasticity is a measurement of the wood's stiffness. MOE represent the ratio of stress placed on the wood compared to the strain, or deformation, the wood exhibits along its length.

For wood poles, the MOE values should be considered as mean values, reflecting the global measure of stiffness.

Source of Data

MOE values were previously published in the Rural Utilities Service (RUS) Bulletin 1724-200 ***Design Manual for High Voltage Transmission Lines.*** The RUS, however, is uncertain of the original source for the wood pole values.

The ASC O5 Committee determined the MOE values published in the 2022 edition should supersede those published in the RUS Bulletin.

MOE values for Douglas fir, Southern Pine and Western Red Cedar were calculated from data listed in ***Wood Pole Properties – Review and Recommendations for Design Resistance Data, Vols. 1-3***, published by the Electric Power Research Institute (EPRI).

MOE values for other species listed in ANSI O5.1 were derived from other recognized data sources.

For species not listed, designers may use MOE values published in the RUS Bulletin or determine the correct properties from other sources.

Pole Conditioning

Wood poles must undergo conditioning, also called seasoning or drying, to prepare the pole for the preservative treatment process. Conditioning can affect the fiber strength and MOE values for each species. The effects of conditioning are accounted for in the published design values.

ANSI O5.1 defines four methods of conditioning: air seasoning, Boulton drying, steam conditioning and kiln drying.

Conditioning is often specific to the species of the pole. For example, Boulton drying is used exclusively for Douglas fir and Larch, while steam conditioning is predominately used for Southern Pine.

In ANSI O5.1, design values are organized based on the conditioning method and species. However, the values for each species do not differ based on the conditioning, only for each respective species.

Pole Design

ANSI O5.1 provides guidance for utilizing fiber strength and MOE values in designing wood pole overhead systems.

Annex A of the standard details design practices and adjustments for poles less than 60 feet in length, more than 60 feet long and for multi-pole structures.

Annex B details groundline stresses and calculations, while Annex C describes reliability based design for wood poles.

It is recommended that designers review the full ANSI O5.1 standard for a full understanding of fiber strength and MOE values in designing wood utility poles.

Web Resources

ANSI O5.1-2022 - Wood Poles
https://wwpi.info/O51-22

ANSI O5.3-2021 - Wood Crossarms
https://wwpi.info/O53-21

Rural Utilities Services (RUS) Bulletins
https://wwpi.info/RUS-bulletins

Electric Power Research Institute (EPRI)
https://www.epri.com

Fiber Strength, Modulus of Elasticity (MOE) for Common Wood Pole Species

Species	Conditioning	Fiber Strength (psi)	Fiber Strength (kPa)	Modulus of Elasticity (10^6 psi)[1]	Modulus of Elasticity (GPa)[1]
Douglas fir, coastal [2]	Boulton drying Kiln drying	8000	55200	2.38	16.40
Western Larch	Boulton drying Kiln drying	8400	57900	2.65	18.27
Southern Pine	Steam conditioning Kiln drying	8000	55200	2.13	14.68
Western Red Cedar	Air seasoning Kiln drying	6000	41400	1.43	9.86
Lodgepole Pine	Air seasoning Kiln drying	6600	45500	1.66	11.44
Red (Norway) Pine	Air seasoning Kiln drying	6600	45500	1.47	10.13
Radiata Pine [3]	Air seasoning Kiln drying	6600	45500	1.54	10.62
Scots Pine [4]	Air seasoning Kiln drying	7800	53800	1.16	8.0

Source: *ANSI O5.1 -2022 – Wood Poles: Specifications and Dimensions*

1 The Modulus of Elasticity (MOE) represents a mean value.

2 Where Douglas fir poles are through bored prior to treatment, to account for the process the designated fiber strength shall be reduced 5 percent to 7600 psi (52440 kPa).

3 Radiata pine includes only material produced in Chile between south 33° and south 40° latitude, is limited to no more than 45 feet in length and limited to pole class sizes 4-10.

4 Data source for Scots Pine MOE is BS EN 14229.

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