EFFECT OF MOISTURE CONTENT ON DOWEL-BEARING STRENGTH

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ABSTRACT

Dowel bearing strength (embedment strength) is a critical component of wood connection design. Previous tests have concentrated on defining the relationship between dowel-bearing strength, specific gravity, and fastener characteristics such as diameter. However, because adoption of yield theory in defining connection strength is relatively new in the United States, few studies have been conducted that completely define the factors influencing dowel-bearing strength. One such factor is moisture content. In this study, the dowel-bearing strength of two groups of specimens was determined. One group was made up of approximately 200 clear Southern Pine pieces distributed evenly among five different moisture content environments (4%, 6%, 12%, 19%, and green) and loaded with 12.7-mm- (0.5-in.-) diameter bolts. The second group included Southern Pine, Douglas Fir–Larch, and Spruce–Pine–Fir specimens in two moisture content environments (6% and 20+%) that were loaded with 3.33-mm (0.131-in.) (8d) smooth shank nails. An empirical linear relationship was developed between dowel-bearing strength and moisture content using the first group of specimens, which compared favorably with results from the second group. These results show that the dowel-bearing strength–moisture content relationship was not dependent on species or fastener type, and therefore, those parameters were not included in the model. Auxiliary tests verified previous research that has shown that dowel-bearing strength (parallel-to-grain) is positively correlated with ultimate parallel-to-grain compression strength.

Keywords: Wood, moisture content, dowel-bearing strength, embedment strength, compression stress, mechanical fasteners.

INTRODUCTION

Editions of the National Design Specification for Wood Construction (NDS) prior to 1991 based allowable lateral strength values for dowel fasteners (nails, screws, and bolts) on empirical equations. The 1991 NDS (AF&PA 1991) first adopted a yield model design methodology for laterally loaded, single-fastener connections. Since then, the 1996 Load and Resistance Factor Design for Engineered Wood Construction (LRFD) adopted the yield model for its laterally loaded connection provisions (ASCE 1996). This yield model has been referred to as the European yield model (EYM) because it was first developed in Europe by Johansen (1949).

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