



# Standard Practice for Testing and Use of a Random Number Generator in Lumber and Wood Products Simulation<sup>1</sup>

This standard is issued under the fixed designation D5124; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice gives a minimum testing procedure of computer generation routines for the standard uniform distribution. Random observations from the standard uniform distribution,  $R_U$ , range from zero to one with every value between zero and one having an equal chance of occurrence.

1.2 The tests described in this practice only support the basic use of random number generators, not their use in complex or extremely precise simulations.

1.3 Simulation details for the normal, lognormal, 2-parameter Weibull and 3-parameter Weibull probability distributions are presented.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* See specific warning statement in 5.5.3.

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

E456 [Terminology Relating to Quality and Statistics](#)

## 3. Terminology

3.1 *Definitions:*

3.1.1 *period*—the number of  $R_U$  deviates the computer generates before the sequence is repeated.

3.1.2 *seed value*—a number required to start the computer generation of random numbers. Depending upon the computer system, the seed value is internally provided or it must be user specified. Consult the documentation for the specific random number generator used.

3.1.3 *serial correlation*—the statistical correlation between ordered observations. See 5.2.2.

3.1.4 *standard normal deviate,  $R_N$* —a computer generated random observation from the normal probability distribution having a mean equal to zero and standard deviation equal to one.

3.1.5 *standard uniform deviate,  $R_U$* —a random observation from the *standard uniform distribution*.

3.1.6 *standard uniform distribution*—the probability distribution defined on the interval 0 to 1, with every value between 0 and 1 having an equal chance of occurrence.

3.1.7 *trial*—a computer experiment, and in this standard the generation and statistical test of one set of random numbers.

## 4. Significance and Use

4.1 Computer simulation is known to be a very powerful analytical tool for both practitioners and researchers in the area of wood products and their applications in structural engineering. Complex structural systems can be analyzed by computer with the computer generating the system components, given the probability distribution of each component. Frequently the components are single boards for which a compatible set of strength and stiffness properties are needed. However, the entire structural simulation process is dependent upon the adequacy of the standard uniform number generator required to generate random observations from prescribed probability distribution functions.

4.2 The technological capabilities and wide availability of microcomputers has encouraged their increased use for simulation studies. Tests of random number generators in commonly available microcomputers have disclosed serious deficiencies (1).<sup>3</sup> Adequacy may be a function of intended end-use. This practice is concerned with generation of sets of random numbers, as may be required for simulations of large populations of material properties for simulation of complex structures. For more demanding applications, the use of packaged and pretested random number generators is encouraged.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.05 on Wood Assemblies.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The boldface numbers in parentheses refer to the list of references at the end of this standard.