



## Standard Guide for Application of Basic Statistical Methods to Weathering Tests<sup>1</sup>

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### 1. Scope

1.1 This guide covers elementary statistical methods for the analysis of data common to weathering experiments. The methods are for decision making, in which the experiments are designed to test a hypothesis on a single response variable. The methods work for either natural or laboratory weathering.

1.2 Only basic statistical methods are presented. There are many additional methods which may or may not be applicable to weathering tests that are not covered in this guide.

1.3 This guide is not intended to be a manual on statistics, and therefore some general knowledge of basic and intermediate statistics is necessary. The text books referenced at the end of this guide are useful for basic training.

1.4 This guide does not provide a rigorous treatment of the material. It is intended to be a reference tool for the application of practical statistical methods to real-world problems that arise in the field of durability and weathering. The focus is on the interpretation of results. Many books have been written on introductory statistical concepts and statistical formulas and tables. The reader is referred to these for more detailed information. Examples of the various methods are included. The examples show typical weathering data for illustrative purposes, and are not intended to be representative of specific materials or exposures.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

D 1898 Practice for Sampling of Plastics<sup>2</sup>

E 41 Terminology Relating to Conditioning<sup>3</sup>

G 113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials<sup>3</sup>

G 141 Guide for Addressing Variability in Exposure Testing on Nonmetallic Materials<sup>3</sup>

#### 2.2 ISO Documents:

ISO 3534/1 Vocabulary and Symbols – Part 1: Probability

and General Statistical Terms<sup>4</sup>

ISO 3534/3 Vocabulary and Symbols – Part 3: Design of Experiments<sup>4</sup>

### 3. Terminology

3.1 *Definitions*—See Terminology G 113 for terms relating to weathering, Terminology E 41 for terms relating to conditioning and handling, ISO 3534/1 for terminology relating to statistics, and ISO 3534/3 for terms relating to design of experiments.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *arithmetic mean; average*—the sum of values divided by the number of values. **ISO 3534/1**

3.2.2 *blocking variable*—a variable that is not under the control of the experimenter, (for example, temperature and precipitation in exterior exposure), and is dealt with by exposing all samples to the same effects

3.2.2.1 *Discussion*—The term “block” originated in agricultural experiments in which a field was divided into sections or blocks having common conditions such as wind, proximity to underground water, or thickness of the cultivatable layer. **ISO 3534/3**

3.2.3 *correlation*—in weathering, the relative agreement of results from one test method to another, or of one test specimen to another.

3.2.4 *median*—the midpoint of ranked sample values. In samples with an odd number of data, this is simply the middle value, otherwise it is the arithmetic average of the two middle values.

3.2.5 *nonparametric method*—a statistical method that does not require a known or assumed sample distribution in order to support or reject a hypothesis.

3.2.6 *normalization*—a mathematical transformation made to data to create a common baseline.

3.2.7 *predictor variable (independent variable)*—a variable contributing to change in a response variable, and essentially under the control of the experimenter. **ISO 3534/3**

3.2.8 *probability distribution (of a random variable)*—a function giving the probability that a random variable takes any

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<sup>2</sup> Discontinued 1998; see 1997 *Annual Book of ASTM Standards*, Vol 08.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 14.04.

<sup>4</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.