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Standard Practice for Identifying Tire Tread Surface Irregular Wear Patterns Resulting from Tire Use[1]

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INTRODUCTION

One of the main performance characteristics of tires is the treadlife, defined as the number of kilometres or miles to wear-out, or where the condition of the tread pattern requires the removal of the tire. Before reaching the condition called "wear-out," intermediate conditions of treadwear are frequently encountered, both in tire testing and in normal tire use, that are characterized by complex topological tread pattern features usually called "irregular wear." When irregular wear is present, certain other tire performance features, such as noise and handling, may fall below acceptable norms. Therefore, it is important in tire development testing and the assessment of tire use performance to be able to describe accurately the condition of the worn surface of tires.

Over the years, different descriptive names have been given to these worn tread pattern features. A standardized nomenclature system is needed to be able to identify the features that are present and describe the intensity or magnitude of these features. This practice is intended to give sufficient instructions to permit an evaluation of irregular wear. To describe adequately the features of these tread patterns, it is necessary to develop a special logical progressive sequence of definitions or descriptions.

1. Scope

1.1 This practice provides the instructions and nomenclature to evaluate the wear features of the tread pattern on a tire for some intermediate state short of total wear out.

1.2 A tire may be characterized by certain worn tread pattern conditions that are collectively referred to as "irregular wear" features. Definitions for these features are given in a special logical and conceptual sequence. First, basic tread pattern definitions are given. Then, additional tread pattern definitions directly related to the basic tread pattern definitions are given. Understanding these secondary definitions requires the knowledge of the basic definitions.

1.3 Based on the terms of this developed system of tread pattern definitions or descriptions, a set of treadwear descriptions is presented that encompasses both regular wear and irregular wear features.

1.4 This hierarchical arrangement produces the accurate and concise definitions needed to evaluate the complex irregular wear conditions of tires.

1.5 See Fig. 1 for tread pattern features or characteristics. See Fig. 2 and Fig. 3 for typical illustrations of regular or uniform and irregular treadwear features.

2. Significance and Use

2.1 This practice fulfills the need for a standardized system for identifying and describing the tread pattern features of tires that are characteristic of intermediate states of treadwear short of total wear out. This descriptive capability is especially important in testing programs devoted to the development of improved performance tires. It is also important in assessing and evaluating tires after periods of typical tire usage.

3. Elementary Features of Tire Tread Patterns

3.1 All tires contain an annular volume of rubber, the outside surface of which comes into contact with the pavement as a loaded tire rotates in vehicle use. This is defined below as a tread band. If surface voids are introduced into this tread band, the usual configuration of these voids produces a geometric pattern of remaining surface projections or elements, that is, regions of the tread band that contact the pavement, collectively called a tread pattern.

4. Tire Inspection

4.1 The tread pattern of tires for inspection and evaluation should be clean and free of debris. Tires may be inspected

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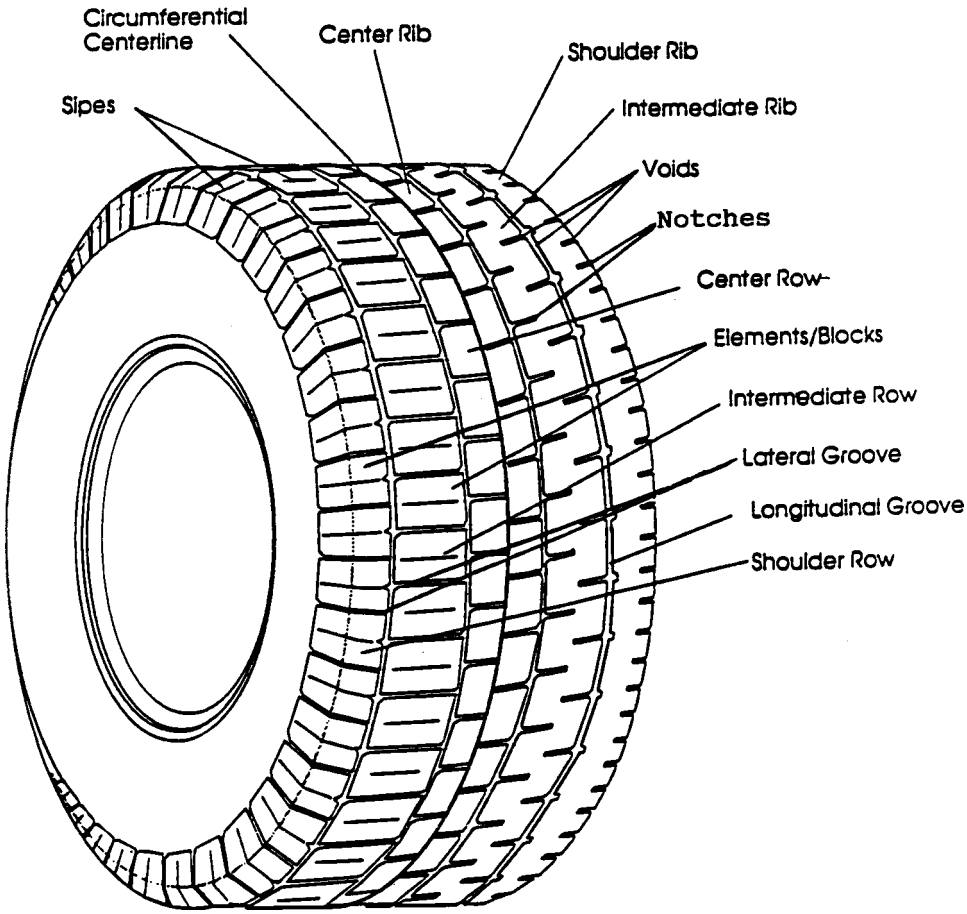


FIG. 1 Tread Pattern Characteristics

FIG. 2 Uniform or Regular Wear

unmounted (off a rim), but it is recommended that tires be mounted and inflated to normal recommended inflation pressure.

4.2 Position the tire to be evaluated in a vertical orientation (that is, the plane of the tire is vertical) on a fixture that permits rotating the tire. Provide sufficient illumination for viewing the tread pattern. A movable secondary source of illumination with a light path tangential to the tread surface is often useful for viewing subtle wear features.

4.2.1 Observe the entire tread pattern of the tire and record the treadwear features of the tire according to the wear nomenclature system as given in Sections 7 and 8.

4.3 There are two options for recording the observed tread pattern features:

4.3.1 *Option 1*—Record all of the features observed on the tread pattern, or

4.3.2 *Option 2*—Record all of the features observed on the tread pattern with a qualitative indication of the magnitude or intensity of each feature. Recommended qualifiers are: slight, moderate, or severe.

5. Basic Definitions of General Tread Pattern Features

5.1 *tread band, n*— an annular volume of rubber that encompasses the outer pavement contacting periphery of a tire; the width is normally much greater than the thickness, and both of these dimensions vary with tire size.

5.2 *void, n*—a volume (in the tread band) defined by the lack of rubber; the depth dimension of this volume may vary from point to point in (on) the tread band.

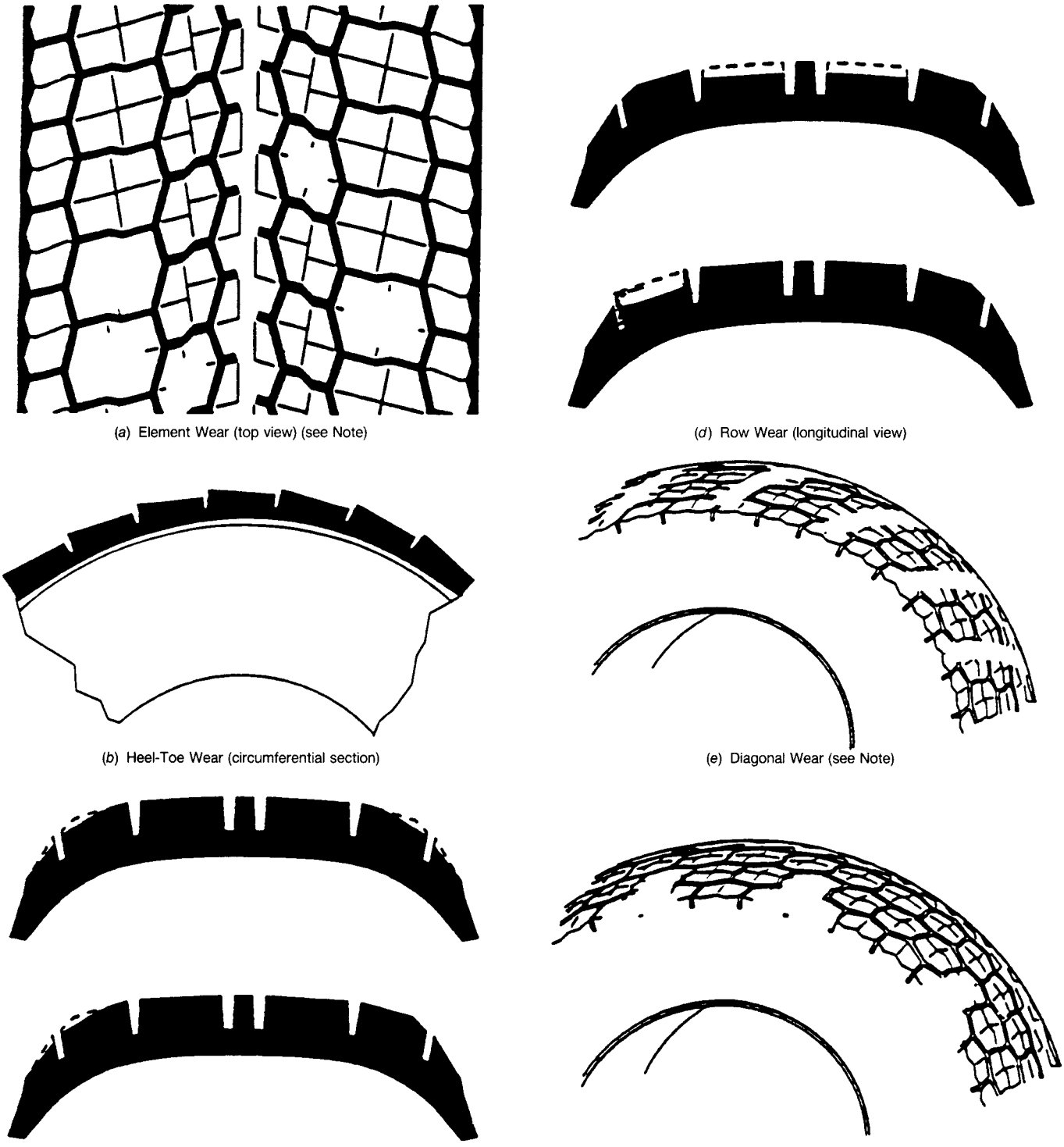
5.3 *groove, n*—a void that is relatively narrow compared to its length.

5.4 *projection, n*— a pavement contacting area of the tread band bounded by void.

6. Definitions of Subclassifications of Basic Tread Pattern Features

6.1 Grooves are major features that may be characterized as follows:

6.1.1 *longitudinal groove, n*—an endless groove that has its major (long) dimension substantially parallel to the tire circumferential centerline; the walls of the groove may not be



NOTE 1—In illustrations (*a*), (*e*), and (*f*) the 'light' or 'featureless' areas indicate high wear rate zones.

FIG. 3 Types of Irregular Wear

perfectly parallel planes, but may have short alternating sections of the wall at angles to the tire circumferential centerline.

6.1.2 *lateral groove, n*—a groove that has its long dimension oriented at a direction nonparallel to the tire circumferential centerline; it most frequently opens into a void at both ends.

6.2 Secondary groove-like features are defined as follows:

6.2.1 *notch, n*—a groove smaller in both width and length than a lateral groove that contains one closed end.

6.2.2 *sipe, n*—a molded or cut rectangular void that is substantially narrower than the major grooves or voids.

6.3 Projections are major pavement contacting tread band regions, defined as follows:

6.3.1 *rib, n*—a continuous circumferential projection.

6.3.2 *shoulder rib, n*—a rib at or near the outer edge or shoulder of the tread band.

6.3.3 *center rib, n*—a rib at or near the circumferential centerline of the tread band.

6.3.4 *intermediate rib, n*—one or more rib(s) located between the centerline and the shoulder ribs of the tread band.

6.3.5 *element, n*—an isolated (totally bounded by void) projection.

6.3.6 *block, n*—synonym for *element*.

6.3.7 *row, n*—a rib or a continuous collection of elements that lie on a circumferential line parallel to the circumferential centerline of the tread band.

6.3.8 *shoulder row, n*—a row located at or near the shoulder of the tread band.

6.3.9 *center row, n*—a row located at or near the circumferential centerline.

6.3.10 *intermediate row, n*—a row located between the circumferential centerline and the shoulder ribs/rows of the tread band.

7. General Treadwear Definitions

7.1 *uniform wear, n*—a type of treadwear characterized by equal tread loss both from projection to projection and from point to point on a given projection, resulting in a smooth appearance of all parts of the tread pattern.

7.2 *regular wear, n*—synonym for *uniform wear*.

7.3 *irregular wear, n*—a type of treadwear characterized by substantial variations of tread loss both from projection to projection and frequently from point to point on a given projection.

8. Irregular Treadwear Definitions

8.1 Descriptions of irregular wear are given in three categories: (*1*) intraprojection wear features, (*2*) interprojection wear features, and (*3*) independent (of projection) wear features.

8.2 *Intra-projection (Irregular) Wear Features:*

8.2.1 *intra-projection wear, n*—a type of irregular wear characterized by a different wear rate at two or more locations within a given projection.

8.2.2 *heel-toe wear, n*—a type of irregular wear characterized by different wear rates at the leading and trailing edges of a projection (element).

8.2.3 *feathering, n*—a type of element irregular wear characterized by thin strips of rubber extending from the edge of the element.

8.3 *Inter-projection (Irregular) Wear Features:*

8.3.1 *inter-projection wear, n*—a type of irregular treadwear characterized by different wear rates on one or more adjacent projections (either transverse or circumferential orientation); this results in a step-off in tread depth between the adjacent projections.

8.3.2 *shoulder wear, n*—a type of irregular wear characterized by an increased wear rate in the outer edge of the shoulder rib or row compared to the inner shoulder edge.

8.3.3 *row/rib wear, n*—a type of irregular wear characterized by a greater wear rate in one or more rows/ribs; the increased wear rate may occur at one or more circumferential locations in (on) a given row/rib and is independent of (that is, occurs across) individual projections resulting in a step-off in tread depth between adjacent rows/ribs.

8.3.4 *step wear, n*—a synonym for *row/rib wear*.

8.3.5 *center wear, n*— a type of irregular wear characterized by a wear rate continuously increasing from shoulder to center of the tread band.

8.4 *Independent (Irregular) Wear Features:*

8.4.1 *diagonal wear, n*—a type of irregular wear characterized by an increased wear rate region or band oriented transversely (from shoulder to shoulder) at some non-90° angle with respect to the circumferential centerline of the tread band.

8.4.2 *cupping, n*—a type of irregular wear characterized by a variation in wear rate that may be periodic (essentially cycloidally shaped) around the tread band circumference in one or more rows; the variation of loss is essentially independent of individual projections if the pattern contains these projections.

8.4.3 *chip and tear, n*—a special type of irregular wear characterized by a rough tread surface which may contain cracks, abrasion pits, or surface ruptures.

9. Keywords

9.1 irregular wear; tire; tread pattern; tread surface; treadwear; wear pattern