Types of Rail Corrugations

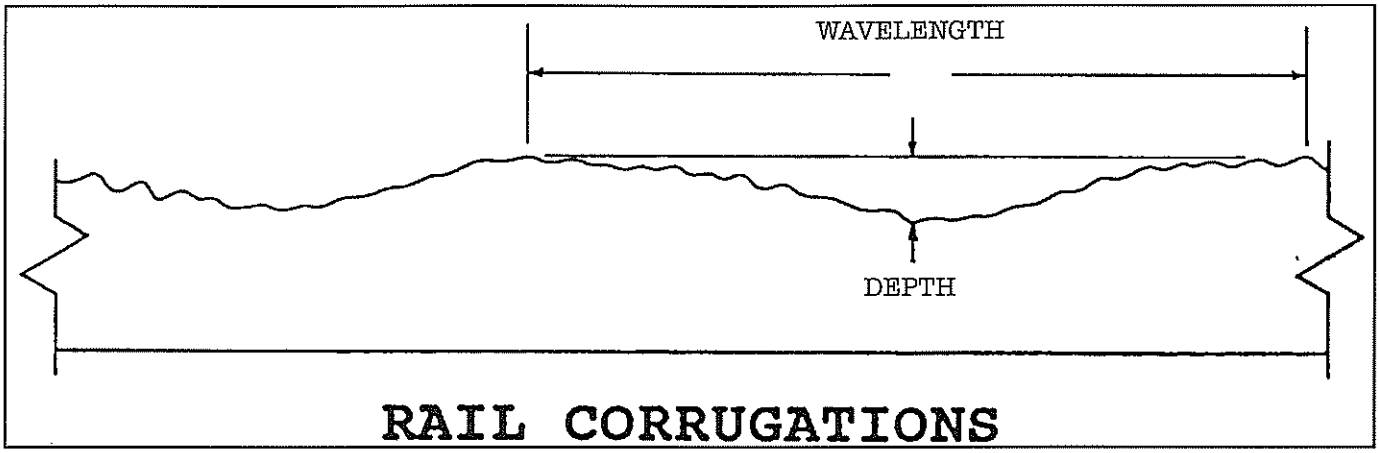

Figure 1 — Rail Corrugations

Corrugations are railhead defects that appear on *all* types of railway operations, from slow, heavy axle load freight operations to high speed intercity passenger operations, including transit and commuter type operations. In spite of major differences in operating characteristics, axle loads and speed, corrugations have been reported on various types of operations, dating back to the turn of the century.

Corrugations have been defined as "rail head anomalies that appear on the surface of the rail in a repeatable, i.e. periodic, manner along the length of the rail." They appear as "waves or regularly spaced (periodic) discontinuities on the surface of the railhead. These waves are not always uniformly spaced but rather tend to vary about some average wavelength."[1]

Corrugations generally are classed in terms of their wavelength, which is the peak to peak (or valley to valley) distance as illustrated in Fig. 1. Corrugation depth is defined as the distance between a peak and an adjacent valley, as illustrated in Fig. 1.

In general, there appear to be three classes or categories of corrugations, defined in terms of their wavelength.[2] However, while there appears to be agreement on the fact of these three categories, there is disagreement as to their proper "names" (terminology) and their specific definitions. This article will attempt to provide a set of definitions based on the most common terminology in the literature.

The three basic types of corrugations are defined as:

1. Short wave corrugations — these have been referred to as "roaring rail," "very short wave" corrugations, or simply as "corrugations." These corrugations have wavelengths in the range of 1 in. to 3 in. (25 mm to 75 mm). They are most frequently associated with high speed passenger, transit and light axle load operations.

2. Long wave corrugations—these have also been referred to as "short waves," "intermediate wave" corrugations or simply "undulations." They have wavelengths in the range of 3 in. to 24 in. (75 mm to 600 mm) and are most frequently associated with heavy axle load freight operations. This class of corrugations has been discussed in an earlier Tracking R&D article (*RT&S* April 1988).

3. Very long wave corrugations—these have been referred to as "long wave" corrugations. These corrugations have wavelengths greater than 24 in. (600 mm) and are usually associated with very high speed operations. This type of corrugation is difficult to observe because of its large wavelength and relatively shallow depth.

Although a tremendous body of literature exists on the theory of corrugation development, there does not appear to exist any one theory that is capable of explaining all of the observed corrugation phenomena. In fact, it now appears that these three types of corrugations repre-

sent different formation mechanisms (or combination of mechanisms) rather than different manifestations of the same mechanism. However, as in the case of many other types of railroad phenomena, railway maintenance officers must continue to deal with these corrugations, even in the absence of any good theoretical explanation for their initiation and development.

References

1. American Railway Engineering Association, *Manual For Railway Engineering*, AREA, Washington, DC. 1988.
2. Zarembski, A. M.. "The Impact of Rail Surface Defects," *Railway Track & Structures*, November 1984.