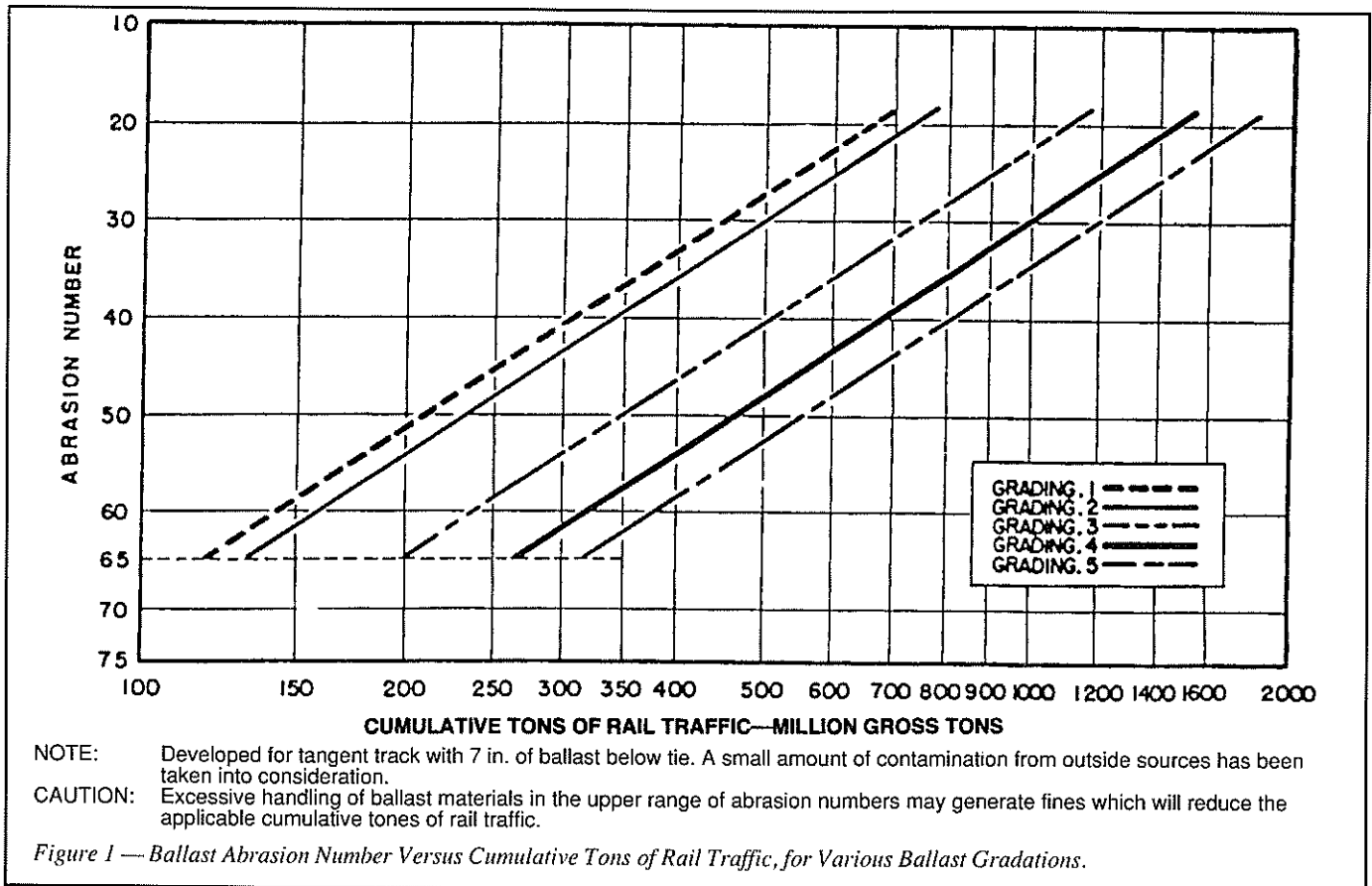


The Many Faces Of Ballast Testing



The question remains of defining appropriate performance parameters and corresponding tests for railway ballast. This is particularly important because the economics of ballast use dictates that "local" sources of ballast be used frequently to avoid the significant expense of hauling the material long distances. Thus, the ability to evaluate key performance characteristics of ballast has been of interest to railroads for many years. It also has been the subject of research activities since the days of A. N. Talbot and his classic studies of the distribution of stresses in ballast.¹

A recent AAR study² surveyed various ballast performance and characterization tests for relationships between the tests, the actual ballast characteristics, and

the performance of the ballast in the field. What emerged is that some test or combination of tests are distinctly better predictors of actual field performance than other more commonly used methods.

This is clearly illustrated in the examination of the hardness and toughness properties of the ballast. Each of these may be defined as follows:² *hardness* of a material is its resistance to abrasion; *toughness* is its resistance to fracture under impact loads.

One test commonly employed, and which is almost universally included in railroad ballast specifications, is the Los Angeles Abrasion (LAA) test. By themselves, the results from this procedure, which in fact is a toughness test and not really an abrasion test, appear to corre-

late poorly with actual field performances. However, when this toughness test is combined with a true abrasion test, such as the Mill Abrasion (MA) test a significantly improved correlation with performance has been observed.³ This combined behavior led to the development of an index referred to as either the Aggregate Index³ or the Abrasion Number² which is related directly to the two values (Abrasion Number = LAA+ 5MA).

This combined index, which is capable of identifying ballast material that is soft but strong, or hard but weak, has since been used to predict the actual life of the ballast in the field. In fact, recent CP research has related abrasion number to observed ballast life, so that the relationship presented in Figure 1 can be used to predict when the ballast should be maintained or replaced. Thus, a direct link has been made between properties measured in a laboratory and actual field behavior.

Other ballast properties

Other properties that are discussed from this point of view are the “weathering resistance” tests. These attempt to predict the performance of ballast under adverse weather conditions, such as repeated freeze-thaw cycling or chemical degradation. While no clearly defined relation between this class of tests and the associated material performance emerges, strong indications suggest that tests such as the Soundness Tests (for example, the Magnesium Sulfate Soundness Test) and the Absorption Tests provide useful information on how the material will behave under severe environmental conditions. These procedures appear to complement the abrasion tests noted above. They repre-

sent a mechanism not present in mechanical breakdown testing.

Importance of ‘shape’

Finally, particle shape was noted as having a potentially large effect on ballast performance in the field. This is so because of the relationship between the shape of the ballast particles and their capabilities for “interlocking” to resist movement under load. Several shape factors and indices are discussed, together with their relationship to performance. While none appears to be a clear indicator, the importance of shape does emerge in defining the performance of ballast in track.

In fact, what can be derived from this report and its quoted sources, is an indication that a combination of four key parameters can provide a correlation between the ballast material and its subsequent performance in the field. These four parameters are: hardness, toughness, shape and weathering resistance. While research activity continues in the area of defining and predicting ballast performance, the ongoing needs of railroads for ballast material require that attention be paid to the trade-off between good performance and actual costs.

References:

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