The Cost of Ballast Maintenance

The relationship between ballast quality and ballast life has been the subject of several recent research efforts. These have been discussed in previous Tracking R&D articles (March 1989, August 1988 and January 1986). Recent efforts, however, have focused on translating ballast degradation behaviors into the overall cost of ballast maintenance.

One such research effort has resulted in the quantification of ballast costs in conjunction with ballast degradation, or "fouling" behavior, within the framework of a spreadsheet-based computer model developed by the AAR (1). Making use of a ballast life relationship developed by CP Rail (2), and presented in an earlier Tracking R&D article (January 1986), ballast-degradation rates were introduced as a function of an "Abrasion Number" (AN), which was defined as the Los Angeles Abrasion value plus five times the Mill Abrasion value. Figure 1 (1) presents an example of degradation behavior as a function of its Abrasion Number.

Average annual cost

Translating degradation behavior into present and future costs, an average annual cost of ballast maintenance can be calculated — taking into account such factors as ballast quality and associated cost, transportation distance and costs, equipment ownership and operating costs, labor costs and productivity (1). Figure 2 (1) presents the results of one such case, where the average annual cost for ballast renewal and maintenance was found to be $5,400 per mile. (This represents an average annual cost. The actual ballast life cycle and surfacing cycles may be at multiple year intervals.) As can be seen in this Figure, ballast material represented approximately 50% of the total cost, and transportation, 25% of the cost. The remaining 25% included labor, equipment and other operating costs. These values compare reasonably well to other studies of ballast surfacing costs (3), where material represented about 40% of the total cost of surfacing, and transportation accounted for approximately 25% of the total (for an "average case"). It should be noted, however, that material and transportation costs can vary significantly depending on the availability of local sources of good-quality ballast (3).

The sensitivity of these ballast costs to several of the above noted factors can be seen in Figure 3 (1). For example, distance that the ballast is hauled can be a major variable, resulting in changes in total annual cost by as much as a factor of two. If hauls as long as 1,000 mi occur, transportation can account for as much as 50%

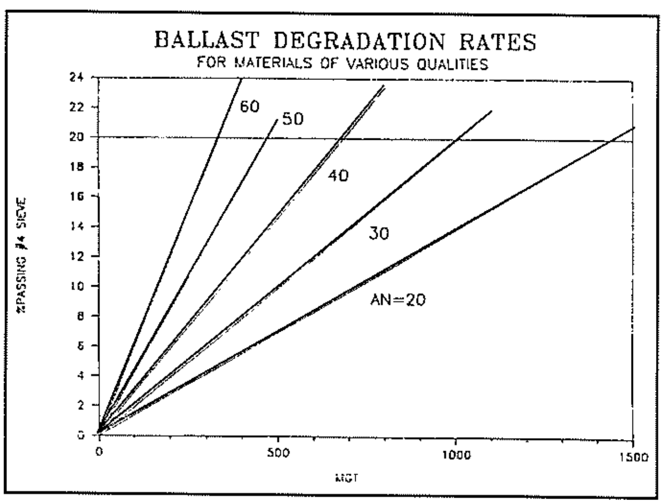

Figure 1 — Example of ballast fouling rate with MGT[1]

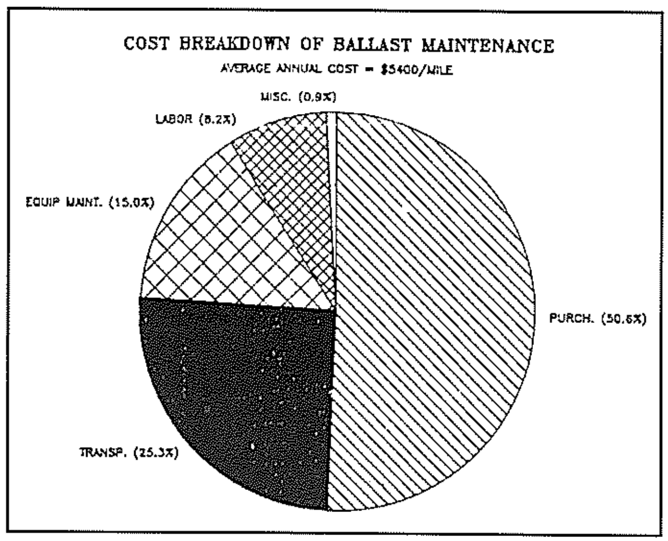

Figure 2 — Breakdown of the average annual cost of ballast[1]

of the overall surfacing costs (3). On-line versus off-line ballast sources also represent a significant cost factor. Ballast quality, or Abrasion Number (see Figure 1), and material cost are also significant factors in the total cost of ballast maintenance. Ballast gradation, however, does not appear to be a significant factor in either ballast life or in corresponding ballast maintenance costs.

As more information becomes available about the relationship between ballast quality and ballast life, the corresponding costs of ballast maintenance become better understood, thus enabling maintenance of way officers to make more cost-effective decisions about ballast material and ballast-maintenance policies.

References

(1) Chrismer, S. M., "Ballast Renewal Model User's Manual," Association of American Railroads Report R-701, March 1989.

(2) Klassen, M. J., Clifton, A. W. and Watters, B. R., "Track Evaluation and Ballast Performance Specifications," Transportation Research Board, Session on Performance of Aggregates in Railroads, Washington, D.C., January 1987.

(3) Burns, D. R., "M/W Cost Components: Part 1 - Surfacing," Railway Track & Structures, April 1987.

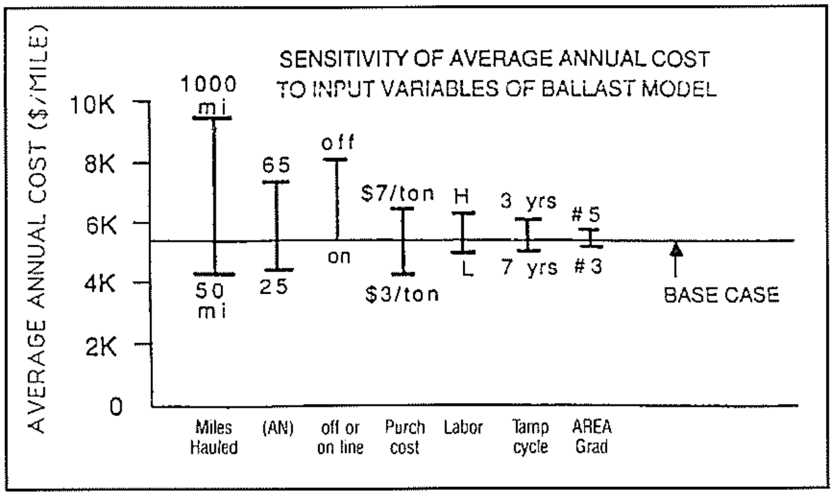

Figure 3 — Effect of input parameters on the per mile average annual cost of ballast maintenance .