Extending Rail Life: Recent Experiences

With rail replacement costs representing the largest portion of a railroad's maintenance-of-way capital budget, it is not surprising that railroads have been continuously seeking methods for extending the life of rail in track. This recent emphasis on rail maintenance has included (and/or resulted in) several sets of practices, all aimed at increasing the life of rail under service conditions. These practices include:

- increased/improved rail lubrication
- rail profile grinding
- increased use of "premium" steels
- improved rail steel quality; both standard and premium
- improved inspection and monitoring of the rail
- reduction/elimination of joints and other "weak spots"
- improved track support and geometry
- improved wheel maintenance

While several of these techniques, such as rail lubrication, for example, have been used to some degree for years, recent research has shown that dramatic increases in rail life can be achieved by *aggressive* maintenance techniques. This, in turn, has led to the adoption of many of these techniques, usually in combination, in order to dramatically increase the service life of rail and, consequently, reduce the outlay of capital dollars for new rail.

In previous Tracking R&D articles, many of these techniques have been discussed in detail. In this article, the results of utilizing these techniques will be presented, based on the reported experience of various railways.

Aggressive rail maintenance

One of the earliest reported examples of the benefits achieved by aggressive rail maintenance is that of Hammersely Iron Railways in Western Australia[1]. Using a rail-maintenance program with a strong emphasis on rail profile grinding, together with a well-maintained wheel condition, curve-rail replacement requirements were dramatically reduced, as illustrated in Figure 1.

This reduction in replacement rail requirements has, likewise, been seen in North America particularly on those railways that have adopted an ongoing rail-maintenance program. Using a combination of the above techniques, to include lubrication, grinding, inspection and use of improved, premium-rail steels, it has been found that both the wear life and the fatigue life of the rail can be extended, resulting in an overall increase in rail life for both curved and tangent track[2,3].

Benefits noted

The effect of such an active rail-maintenance pro-

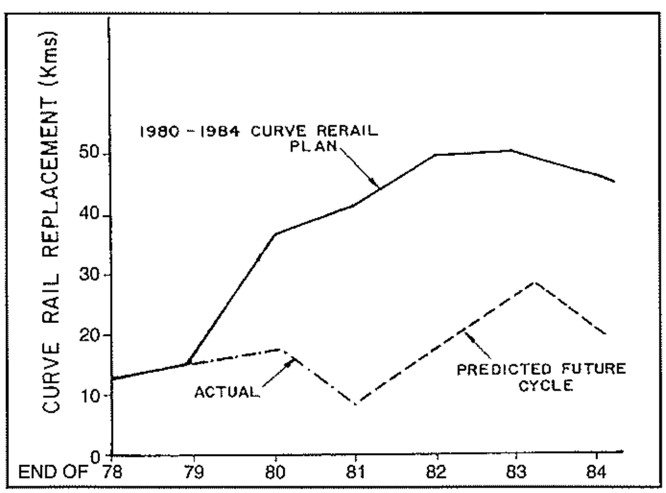

Figure 1 — Effect of aggressive rail maintenance, Hammersely Iron Railway.[1]

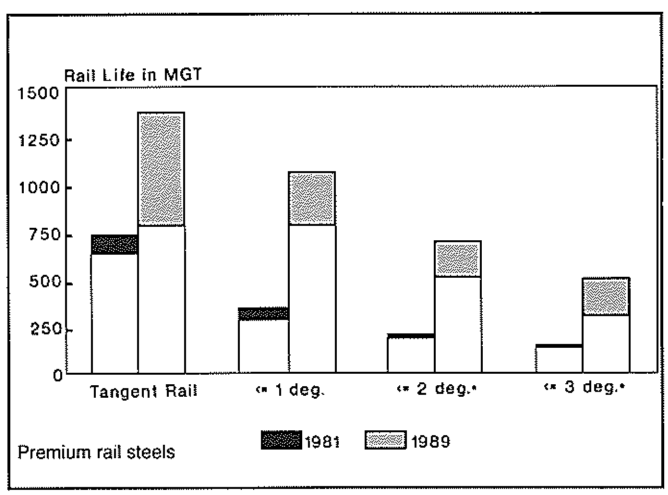

Figure 2 — Average expectations for rail life.[2]

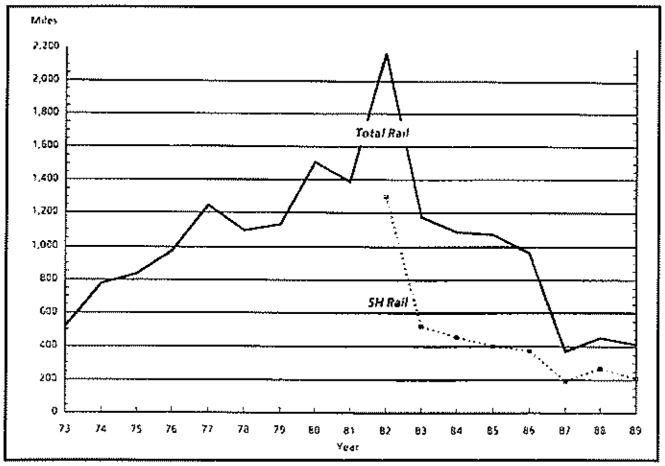

Figure 3 — Total track miles of rail laid per year.[2]

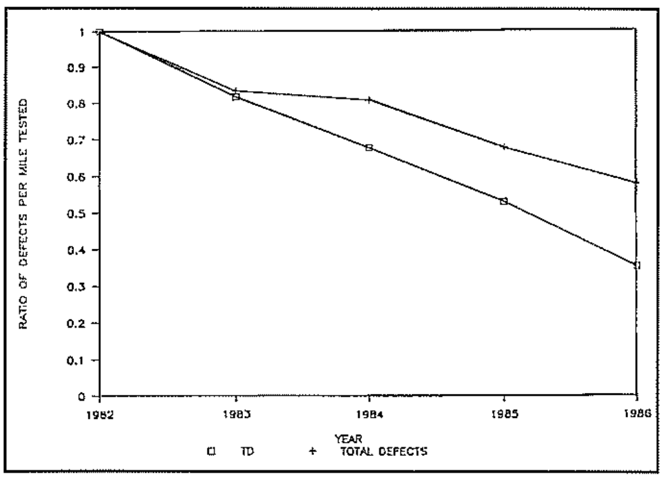

Figure 4 — Rail defects on a major North American railroad (defects normalized by annual miles tested)[3].

gram is clearly illustrated in Figure[2], where the life of rail on one major U.S. railroad has increased by over 25% on tangent track and from 25% to over 100% on curves during the last eight years[2]. The current expectation for tangent rail life on this railway is between 800 and 1,400 MGT, well beyond what was only recently considered to be the maximum life of rail under 100-ton-car traffic. Yet, this increase in rail life occurred while traffic and net loadings on that railroad both increased significantly. The result of this increase in rail life is, as expected, a significant decrease in the need for replacement or relay rail, as illustrated in Figure 3. It should be noted that aggressive rail maintenance, to include profile grinding. was introduced or increased during the early-to-mid-1980s.

Similar behavior trends have been reported by other railways as well. Figure 4 presents the rail defect rate (normalized by miles tested) of another major North American railway which introduced an active rail-maintenance program that included increased use of improved/premium rails and rail profile grinding in the early-to-mid-1980s.[3] Here, too, a significant reduction in the development of rail defects, including rail fatigue defects such as transverse defects, was observed. This reduction in rail defects, in turn, results in a direct increase in the life of rail, particularly in tangents and shallow curves, where fatigue had been the traditional failure mode (*RT&S* Jan. 1985, p. 17).

Thus, it can be seen that improved rail-maintenance practices, particularly when carried out in a planned and co-ordinated fashion, can result in significant improvement in rail service life and in a direct reduction in the need for replacement rail and, thus, rail capital dollars.

References

(1) Lamson, S. T. and Longson, B. H., "Development of Rail Profile Grinding at Hammersely Iron," Second International Heavy Haul Railways Conference, Colorado Springs, Colo., September 1982.

(2) Glavin, W. E., "Rail Grinding, The BN Experience," Bulletin of the American Railway Engineering Association, Volume 90, Bulletin 722, October 1989.

(3) Zarembski, A. M., "The Relationship Between Rail Grinding and Rail Lubrication," Second International Symposium on Wheel/Rail Lubrication, Memphis, Tenn., June 1987.