Forecasting Maintenance Needs

Within the last several years, the subjects of track maintenance planning and the forecasting of track maintenance requirements have emerged as key areas of interest and activity. The development of effective track maintenance planning and forecasting systems can help maintenance officers to effectively plan their short-and long-term maintenance activities. These systems can also help them control their M/W costs.

Earlier *Tracking R&D* columns (May, 1985, April, 1986, and May, 1986) addressed several issues associated with the planning of track maintenance using track geometry as well as general inspection data. However, the activities thus covered had been limited generally to maintenance activities related to track geometry such as gaging, lining, and surfacing. They did not, however, address the forecasting of the life of key track components, for instance rails and ties.

An integrated system

One recent research activity has focused on creating an integrated "Track Maintenance Planning and Forecasting System." This system would permit M/W officers to define their present and future maintenance requirements and also to forecast the imminent and future failure, or degradation of key track components[1]. It attempts, too, to combine a complete track and track component database and an effective database management system with a set of track component failure and/or degradation relationships. This in turn permits the forecasting of system-wide maintenance requirements encompassing both short-term (1 to 3 years) and long-term (3 to 10 years) perspectives.

As noted in the study mentioned, key parts of this type of forecasting system are the track component failure or degradation relationships. These relationships are equations that allow the translation of 'existing' track conditions into component lives and, correspondingly, into the replacement requirements for components.

Homogeneous track segments

By dividing the track system into a series of homogeneous track segments, such that each has a uniform set of track component parameters and a common maintenance history, relationships for individual component failure can be used to predict the life of that component for *each* of the track segments. Then, by consolidating this information for the entire track network, the specific component requirements for the system — for example rail, ties, fasteners, special trackwork and the like — can be predicted on a year-by-year basis.

This type of forecast is illustrated in the accompanying figure and table. These show forecasted rail replacement requirements, based on rail wear, for a small operating property, and as predicted by the maintenance

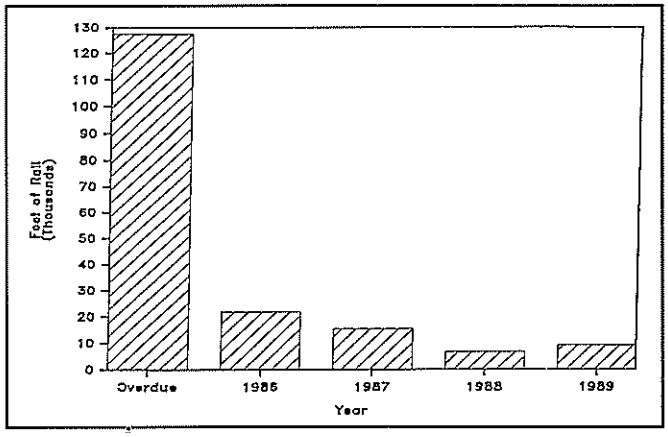

Figure 1 — Forecast: System Rail Requirements

TRACK DEGRADATION ANALYSIS REPORT :
TRACKS DUE FOR MAINTENANCE IN '87

TRACK-ID	STATION (100*ft.)	FOOT (ft.)	RAIL INSTALLATION DATE (yy - mm - dd)	RAIL USEFUL LIFE (yr.)	MAINTENANCE DUE DATE (yy - mm - dd)
IRT-HU-1	175	75	80 - 11 - 16	6.26	87 - 02 - 16
IRT-C -2	32	60	78 - 02 - 13	9.15	87 - 04 - 06
IRT-W -1	100	10	79 - 03 - 20	8.16	87 - 05 - 13
IRT-Y -1	140	10	79 - 12 - 14	7.72	87 - 08 - 31
IRT-B -2	20	0	77 - 08 - 23	10.04	87 - 09 - 04
IRT-C -3	100	10	79 - 03 - 20	8.47	87 - 09 - 04
IRT-B -3	20	0	77 - 08 - 24	10.04	87 - 09 - 05
IRT-B -1	20	0	77 - 08 - 25	10.04	87 - 09 - 06
IRT-MH-1	80	10	76 - 03 - 03	11.60	87 - 10 - 05
IRT-D -3	155	10	80 - 12 - 17	6.93	87 - 11 - 19
IRT-D -2	155	10	79 - 12 - 16	7.99	87 - 12 - 09

Table 1 — Rail Replacement Forecast Report

planning model[1]. The figure presents the forecast rail requirements for that system for the period 1986 to 1989, and it includes as well any overdue or deferred maintenance. The table in turn provides a detailed listing of projected rail requirements for one year (1987). This information is keyed to location and is given maintenance priorities by date. Similar component forecasting can be obtained for other key track components, using appropriately developed relationships for component failure.[1,2]

As noted above, the three key elements of such an integrated Planning and Forecasting System are:

1. An integrated track and track component data base.
2. A series of relations for track component failure/degradation.
3. A database management system; to include a report generating system, a prioritization system, and a calibration and validation system for the failure/degradation relationships.

PC compatible

By effectively combining these three key elements such a planning and forecasting system can be employed on an appropriately-sized computer. For relatively small properties, such as 1000 miles or less, it can be implemented on a conventional micro-processor with a sufficient amount of hard disk memory. This feature is currently available for conventional personal computers (PC types). The planning and forecasting system, then, would be economical to use at a regional or divisional office level as well as at engineering headquarters.

For larger properties, bigger processors like minicomputers or mainframe systems may be required, depending on the size of the track system and the amount of data to be stored and processed.

However, in all cases, it appears that the development and implementation of the maintenance planning and forecasting system described are both feasible and practical. Moreover, such systems provide M/W officers with a cost-effective approach in the management of their assets and in planning for their maintenance needs.

References:

1. Zarembski, A.M. and Goldblatt,R.; "Track Maintenance Planning and Forecasting System; Phase 1: Feasibility;" ZETA-TECH Associates; report prepared under DOT Contract DTRS-57-85-C-00149. April, 1986.
2. Webb, H. G.; Wells, T. R., and Zarembski, A. M.; "Track Maintenance Research Program: An Overview;" Bulletin of the AREA, Volume 82, Bulletin 683, June-July 1981.